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Monster: We Review
5 Next-Generation
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NETWORK
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MAGAZINE

Faster, Smaller, Lighter (And Color)!

- 10 New **SUBNOTEBOOKS**
- 486 Power at 4 Pounds
- The First Color Display



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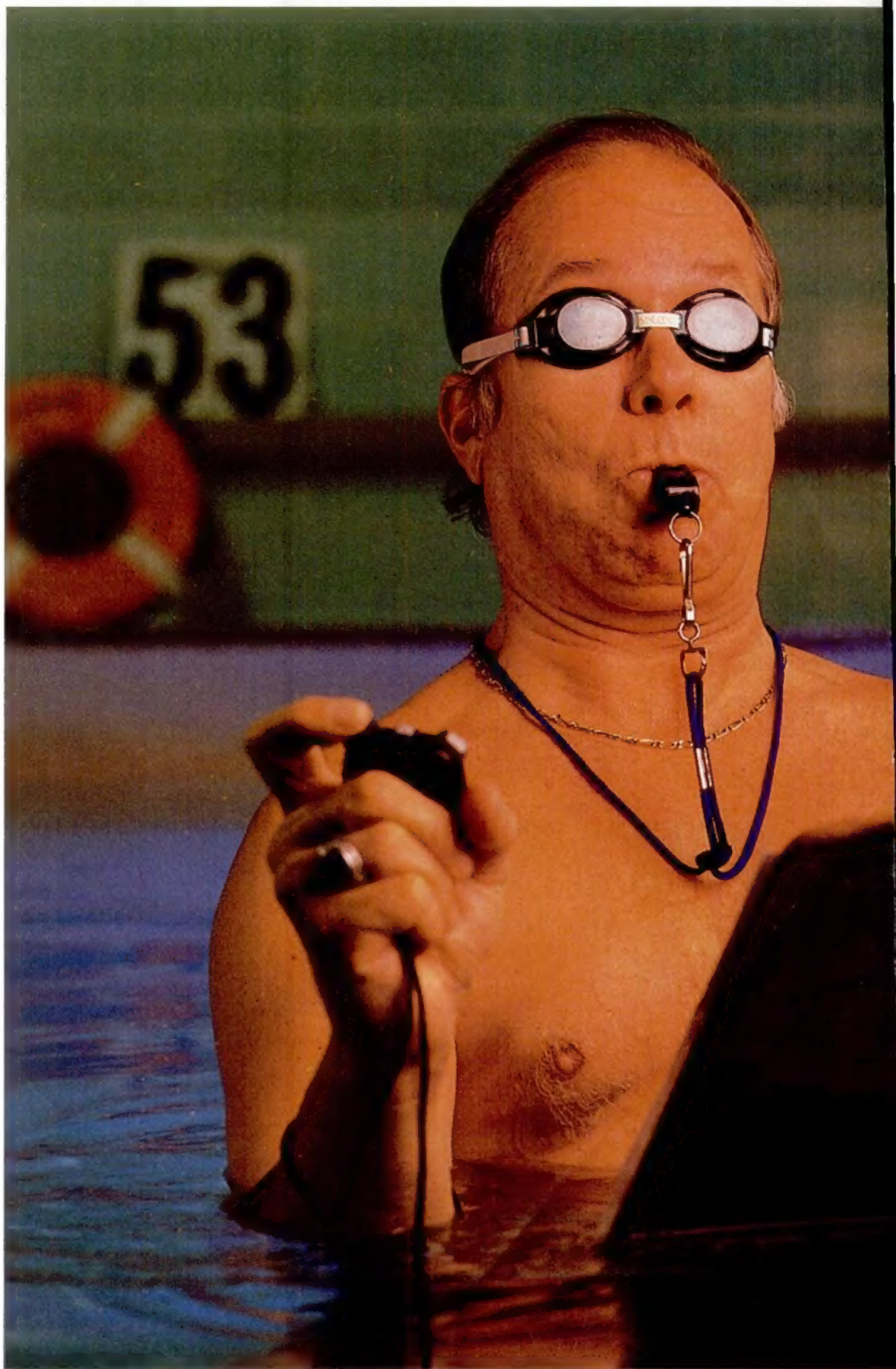


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4. Are your programs recognized as the best in their category?
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6. Do your programs have no-charge product support? For how long?
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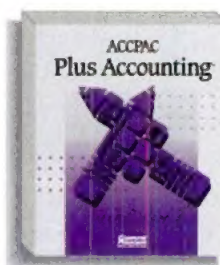
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Inside

One year ago, when we last looked at subnotebooks, we really weren't too sure what we were looking at. A taxonomy of small computers—laptops, palmtops, and kneetops—was just emerging. And the machines we looked at... well, let's just

say they left you with a serious case of eye fatigue.

A year sure changes things. Now, 15 percent of the total notebook market falls squarely into the subnotebook category. These shrunken notebooks are increasingly being used for such tasks as e-mail, light correspondence, and contact management; they've be-

off the standard laptop weight has its price. Our Editors' Choice, the Toshiba Portégé T3400CT, is a road warrior's dream, but it costs \$3,999. You could buy a Pentium for your desktop instead.

Christopher Barr, West Coast senior editor and a subnotebook aficionado, has a keen eye for the realities. "The disks are still too small, the screens too hard to read, and the performance is still questionable," he says. "but the progress has been substantial."

One thing that you wouldn't want to run on a subnotebook is the next generation of C/C++ compilers: Our zealots delve deeply into the bigger-than-ever programming en-



Senior editor Barr—weighing subnotebooks.

vironments from Microsoft, Borland, and new rival Symantec.

Speaking of *big*, we also look at electronic forms. From its humble beginnings in specialty drawing, forms software has matured into robust workgroup computing environments. This year our testing emphasizes the distribution of electronic forms. Small computers, big software—now *that's* a change from the way things used to be.

—Robin Raskin

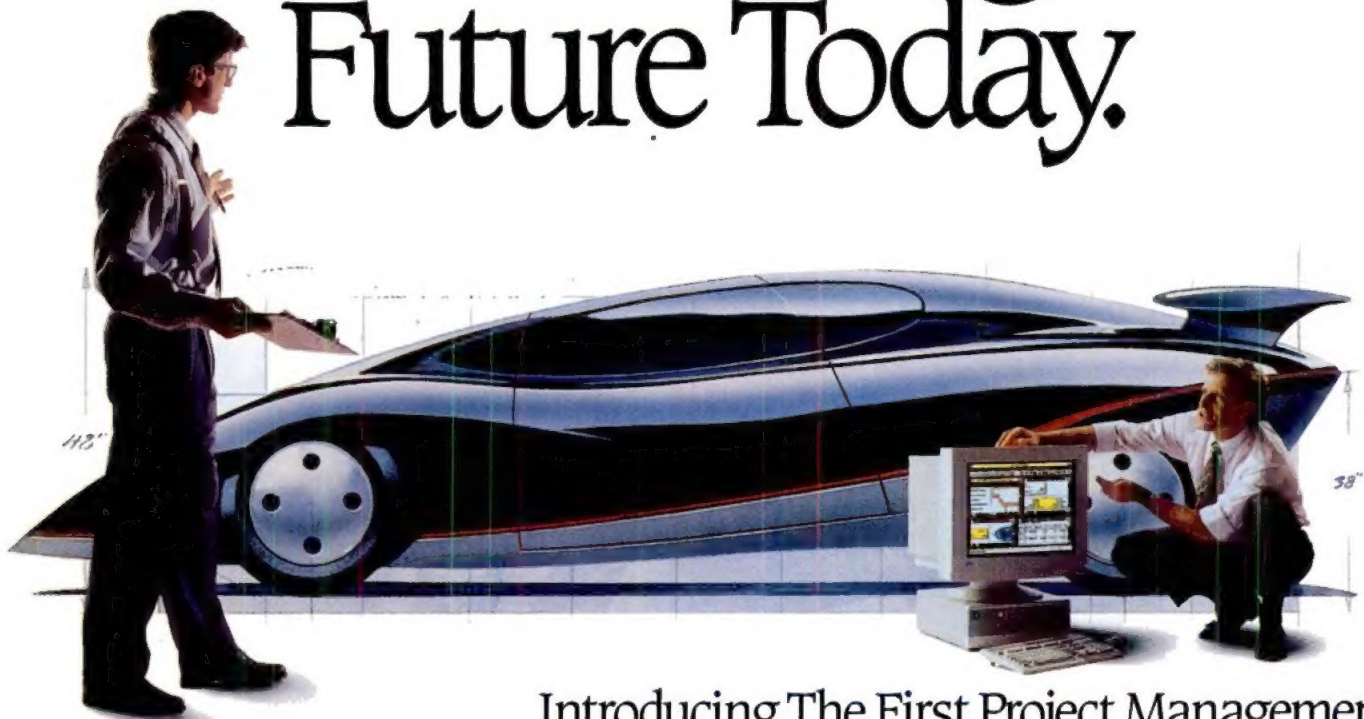
Small computers, big software—now *that's* a change from the way things used to be.

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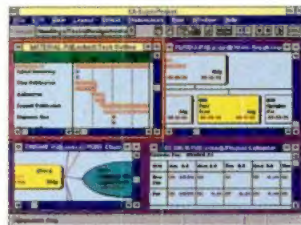
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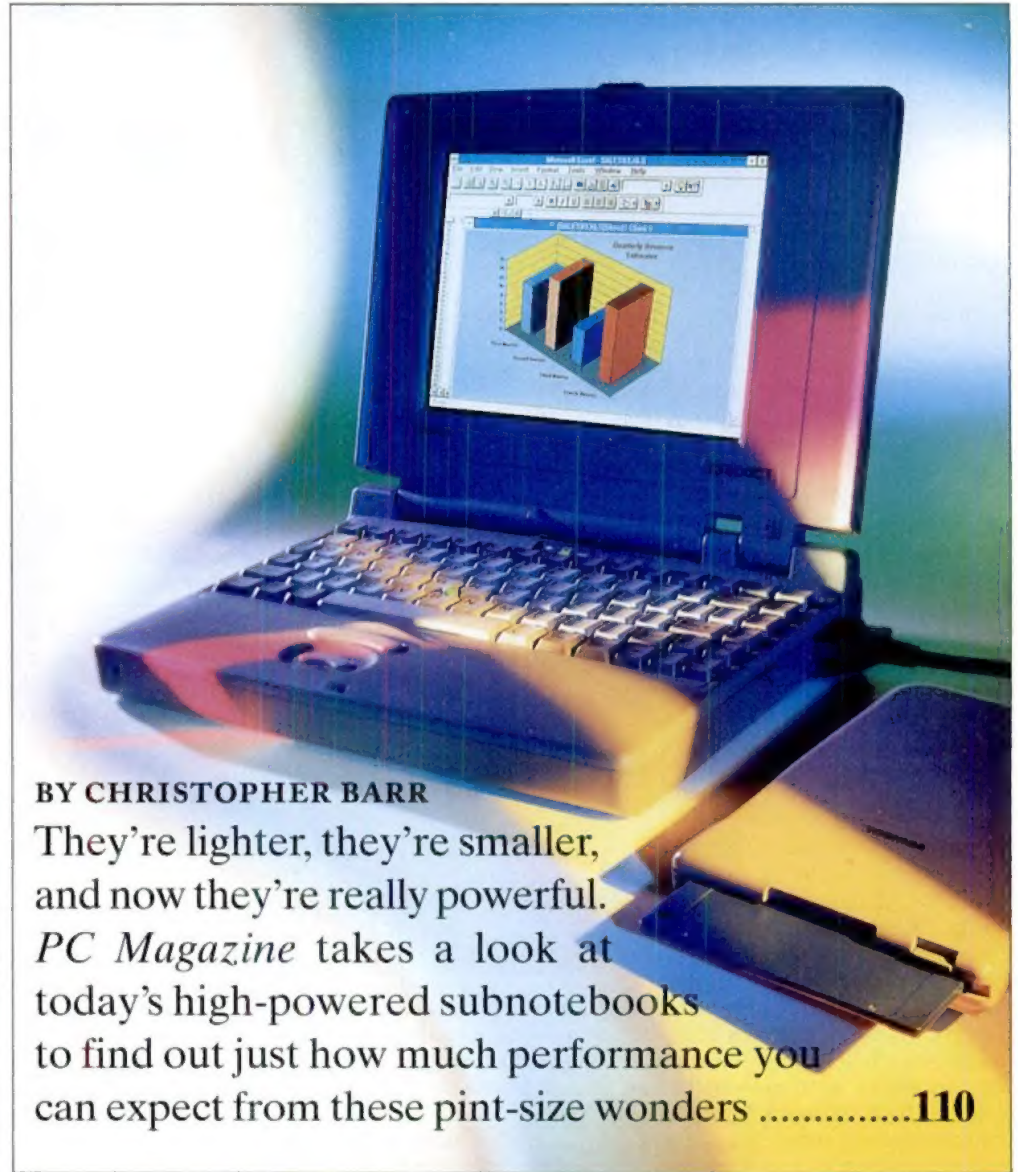
Bill Howard

Grab These Gadgets105

COVER STORY

Subnotebooks

Small Wonders



BY CHRISTOPHER BARR

They're lighter, they're smaller, and now they're really powerful. *PC Magazine* takes a look at today's high-powered subnotebooks to find out just how much performance you can expect from these pint-size wonders110

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Electronic Forms Software

Filling [in the] Blanks

BY LANCE ULANOFF AND JEFF MACE Filling in forms with paper and pencil is still the method we're most familiar with, but that's changing. Today's forms software packages not only give you the means for creating and printing sophisticated forms but also let you enter data and route forms over a network. We review five products that may lead you into the era of the paperless office.....149

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BY SHERYL CANTER This is no quiet revolution. The latest generation of C++ programming tools for Windows, Windows NT, OS/2, and DOS flaunt levels of power undreamed of a year ago. Fully integrated development environments, intuitive visual design tools, Windows application frameworks, intelligent code generators, and support for 32-bit apps are just the highlights. At the same time, traditional command-line tools offer special optimizations that can make your final application shine. *PC Magazine* tests ten C++ development systems—including ground-breaking new releases from Borland, Microsoft, and Symantec—for usability and performance.....185

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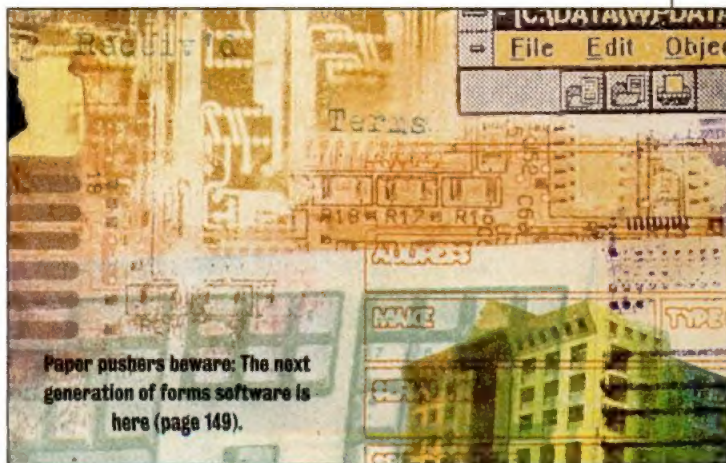
Network Backup

Performing Backup Magic



BY GARY GUNNERSON Let your users think you restore files through sleight of hand. They shouldn't have to worry about network backup when they want you to restore a file that's just been corrupted or lost from a server directory. And to deliver on such a trust, even managers of smaller LANs need an effective backup strategy and a good hardware/software solution with which to implement it. Among the nine packages we look at here are some whose strong features, good performance, and well-designed interfaces make backup less tedious—and file restore less a matter of chance.....227

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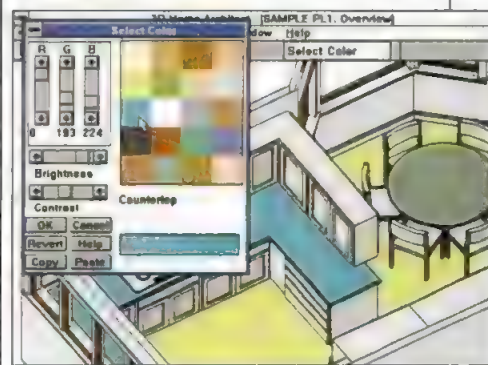
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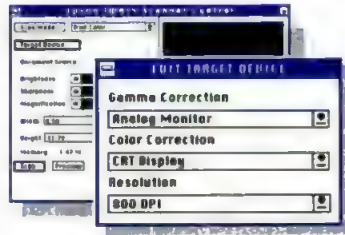


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PC Magazine Reviews

Except where noted: All *PC Magazine* reviews are of currently available products. Benchmark and performance tests are run on Compaq Deskpro 486/33M's.

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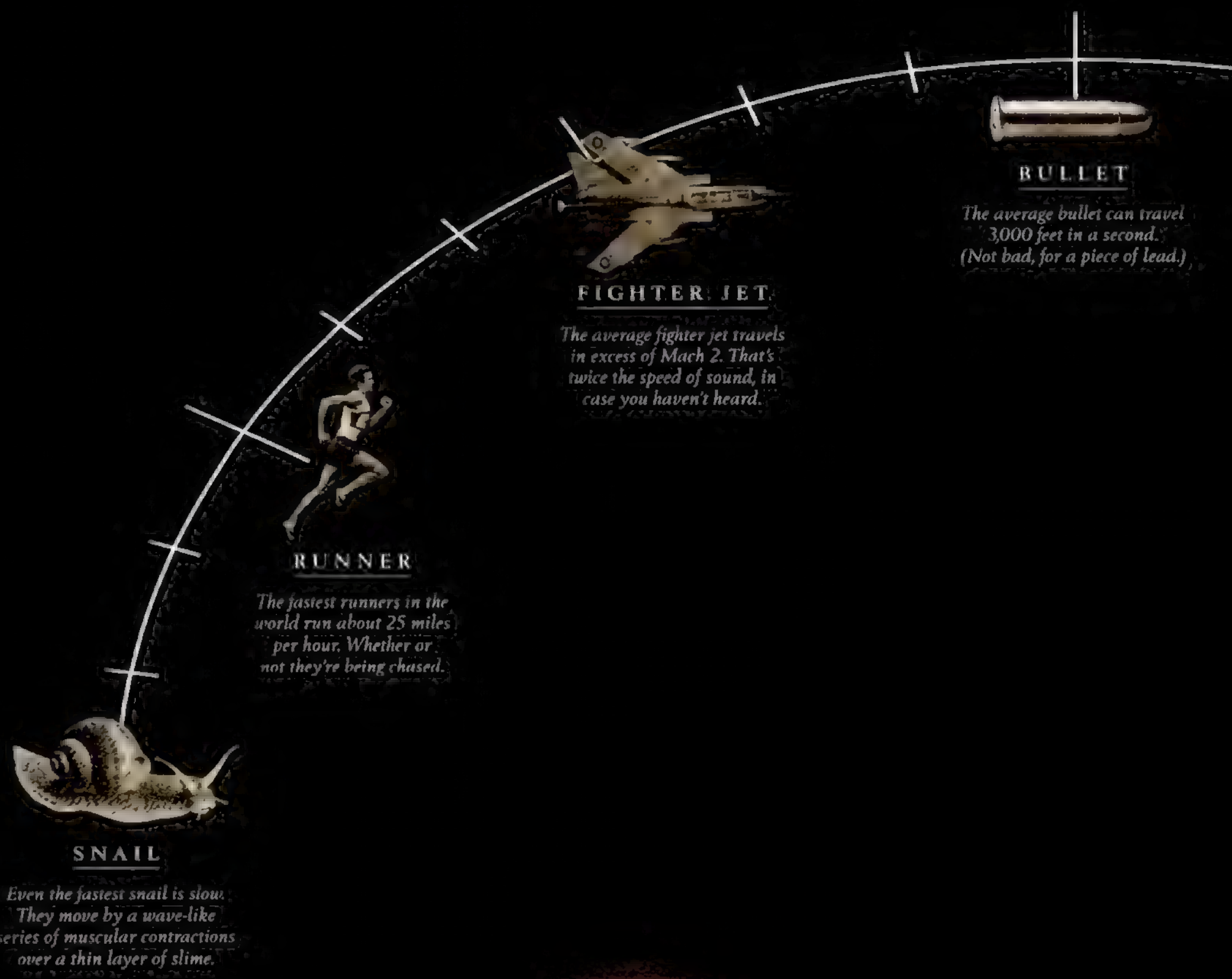
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LETTERS

program, thus requiring users to contact customer service for a reinstallation code.

Ultimately, floppy disks are still preferable, and any convenience of installing software from a single CD-ROM disk must be weighed against the increased cost of purchasing the floppy disks.

*Tom Dowd
via ZiffNet*

RIDING THE WAVE

After reading your January 25, 1994, cover story, "Pentium: The Second Wave," I can only conclude that *PC Magazine* is getting a little long in the tooth and embarrassingly out of date. Although both Microsoft Windows and DOS benchmark test results were provided, the article seemed to emphasize the high Pentium performance under DOS.

Who needs a Pentium to run DOS? It seems to me that power users would be more interested in addressing the performance of 32-bit operating systems such as Microsoft Windows NT, Microsoft Windows for Workgroups 3.11, the forthcoming Chicago, and OS/2 2.1. Perhaps *PC Magazine* should now be referred to as "the magazine for DOS diehards."

*August A. Toda
Manchester, Massachusetts*

CADDY STACK

In the New & Improved mention of the Pioneer DR-U104X quadruple-speed CD-ROM drive (January 11, 1994), you cite the unit's front-loading caddies as a drawback. But a CD caddy is not a drawback. When I get a new CD-ROM disk, I trash the plastic jewel case and instead put the disk in its new, permanent home—a separately purchased caddy. The disk is protected from such hazards as fingerprints, scratches, and being discovered under a memo on which I've just used a ballpoint pen. Furthermore, my CD-ROM drive loads, plays, and ejects the caddies perfectly. Try that with your roll-out tray drive; you'll discover drawbacks you never even dreamed of before.

*G. James Van Osdol
Nokomis, Florida*

CPU TIES

John C. Dvorak's January 11, 1994, Inside Track column suggests microprocessor companies "incorporate a serial number within the silicon itself. It should be something that can be accessed by the processor and checked. This would have the added advantage of minimizing software piracy by associating the software with the one CPU."

Internal serial number? Good idea. But locking software to one CPU? Bad idea. For one thing, it would complicate servicing a computer, for if a CPU, motherboard, or entire computer system is replaced, an elaborate procedure would need to be followed to reinstall software. This suggestion is simply copy protection in another guise.

*George Winman
Normal, Illinois*

SUPPORTING YOUR OWN

Although OS/2 has sold more than 4 million copies, it seems virtually all of your reviews are from the perspective of Microsoft Windows performance and compatibility. While I understand the importance of that perspective, it does little to help us 4 million OS/2 users with our purchasing decisions. Your latest 2MB video board review ("Pumping Pixels," December 7, 1993) noted whether or not the vendor offered OS/2 drivers. But that didn't help OS/2 users, since many of those listed with OS/2 drivers are still in beta or are far from stable.

*Keith Luken
Marietta, Georgia*

CLOUDED CRYSTAL BALL

Bill Howard's January 11, 1994, column is headlined "Ten Predictions for 1994," yet the comments on Microsoft Windows NT discuss what might happen in 1995 or 1996. The item then goes on to discuss the Chicago vaporware and voices the hope that it will ship in 1994. This is a prediction?

Howard also asserts that OS/2 doesn't feel like a winner. What is this supposed to mean? OS/2 2.1 is outselling Windows NT, and it contains most of the features said to be in the as-yet-unreleased Chicago. The copy of OS/2 I run on my home computer not only feels like a winner, it is one.

*Jerry Case
Rockville, Maryland*

NAME THAT TUNE

I must protest. In a letter to the editor (January 25, 1994), Paul J. Camp complained about having the silly Madonna song "Material Girl" buzzing about in his head after seeing an article entitled "Living in an Immaterial World." After reading his letter, I shook my head sadly, thinking, That poor fellow. I then found that to my horror the same malady had spread to my own fragile head, where it stayed for hours.

This is nothing short of a nasty print virus, and you people should know better.

*Jesse Montrose
via ZiffNet*

CORRECTIONS AND AMPLIFICATIONS

In "Network Operating Systems: Playing the Odds" (October 26, 1993), we inadvertently implied that NetWare Loadable Modules (NLMs) can be loaded into ring 0 under NetWare 3.11. Only NetWare 4.x permits NLMs to be loaded into ring 0.

Because of a production error, an incorrect toll-free phone number for Nanao USA Corp. appeared in "The Best of 1993" (January 11, 1994). The correct number is 800-800-5202.

In the Pipeline column "Taxing Times" (January 25, 1994), the names of Parsons Technology's tax software products were misstated. They are Tax Mate and Personal Tax Edge, not Personal Tax Mate.

The correct phone number for the National Technology Transfer Center at Wheeling Jesuit College, Wheeling, West Virginia, is 800-678-6882 (Inside Track, February 8, 1994).

HOW TO WRITE TO PC MAGAZINE

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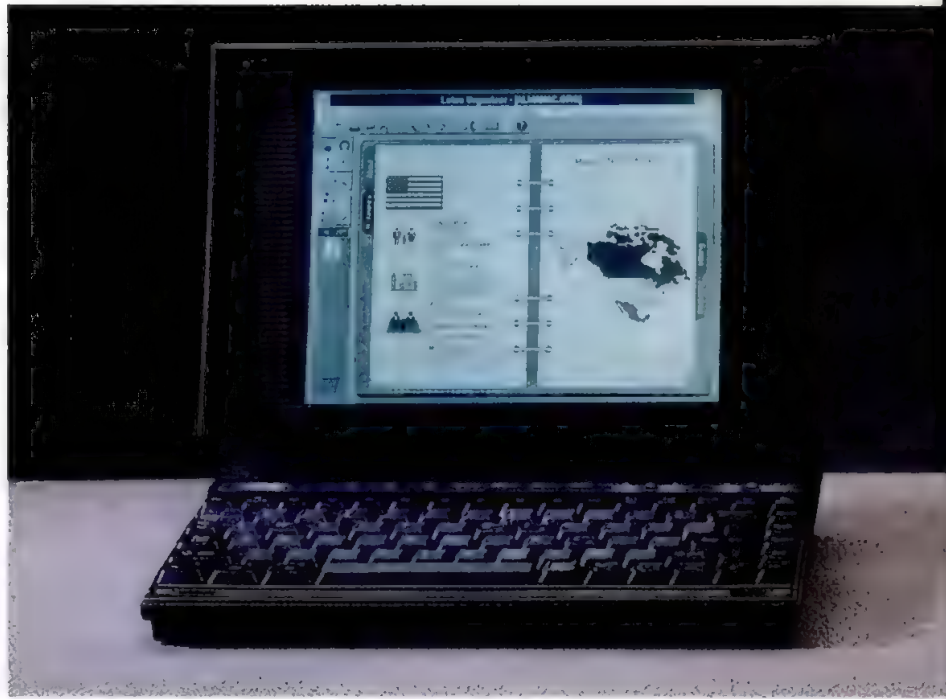
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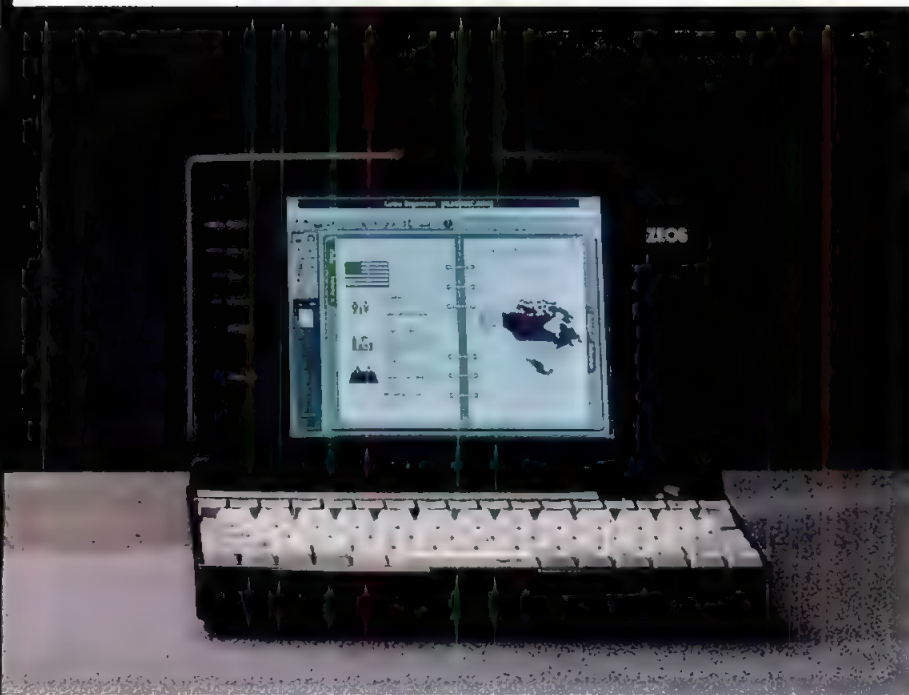
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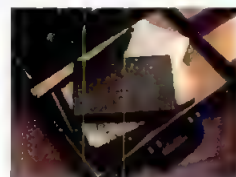
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MERCURY SPORTS
Travel Authorization Request

Employee Information
Name: Lucy Rowland Employee Number: 0001
Title: Eline Design Engineer
Department Name: Irvine Design Facility Department Number:

Trip Information
Brief trip description: SportsWorld '94 Destination(s): Miami
Departure Date: 2/1/94 Estimated cost of trip: \$2,000
Return Date: 2/9/94 Cash Advance Requested:

Authorization from Accounting
Travel Authorization Number: 2536 Cash Advance Amount: 000

1 THIS **NOTES** APPLICATION SHOWS HOW A COMPANY CAN AUTOMATE THE TRAVEL PROCESS. HERE, **NOTES** CONTAINS THE **AMI PRO** TRAVEL REQUEST, THE FREELANCE TRIP PRESENTATION AND THE 1-2-3 EXPENSE REPORT. ANY AUTHORIZED MEMBER OF LUCY'S WORKGROUP MAY ACCESS, SORT AND REPORT ON THE DATA BECAUSE OF THE NEW **NOTES/FX** TECHNOLOGY.

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TAR 3251 01/03/94 Seoul
EXP 01/21/94
TR 01/21/94

2/1/94 - SportsWorld '94
TAR 2536 01/01/94 Miami
EXP 02/18/94
TR 02/18/94

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Jack Armstrong
1/10/94 - Customer Call - Bay Sports
TAR 2909 01/08/94 San Fra
EXP 01/18/94

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Lotus Notes - Expense Estimate vs. Actual

Date	Description	Estimated	Actual
02/25/94	SportsWorld '94	\$2,000	\$3,207 (\$1,207 over)
01/18/94	Customer Call - Bay Sports	\$1,800	\$1,690 (\$110 under)
01/27/94	International Business Review	\$5,800	\$5,913 (\$113 over)
02/10/94	Domestic Marketing Review	\$1,800	\$1,582 (\$218 under)
02/18/94	SportsWorld '94	\$2,000	\$1,875 (\$125 under)
02/18/94	Korean Factory Assessment	\$9,000	\$7,337 (\$1,663 under)
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Freelance Graphics Trip Presentation

Mercury
Trip Report

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Miami
February 1 - 5

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Request	Returning	Expense Total
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1/15/94		\$7,736.70
2/5/94		\$1,875.44
1/11/94		\$1,489.92

Lotus 1-2-3 Release 4 - Expense Report

Mercury
Employee Expense Form

Emp #	Dept #	Emp Name	Expense Vtd Date	Ytd #
0001	101	John Doe	1/15/94	0001

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Mercury

3 WHEN SHE RETURNED FROM HER TRIP, LUCY CREATED A PRESENTATION REPORTING HER SUMMARY ON SPORTS WORLD IN **FREELANCE GRAPHICS**. THIS PRESENTATION WAS ROUTED AS A NOTES DOCUMENT SO OTHER INTERESTED PARTIES IN MARKETING, PRODUCT DEVELOPMENT AND EVEN OTHER SALESPeOPLE ON THE ROAD, LIKE DAVE, CAN QUICKLY ACCESS IT AT THEIR CONVENIENCE.

4 LUCY COMPLETES HER 1-2-3 EXPENSE REPORT FOR THE TRIP, WITH THE ESTIMATED EXPENSES AND THE CASH ADVANCE AMOUNT BEING AUTOMATICALLY ENTERED FROM AMI PRO TO 1-2-3 THROUGH THE NOTES/FX LINK. THE EXPENSE REPORT IS AUTOMATICALLY ROUTED TO HER MANAGER AND THEN TO FRED IN ACCOUNTING.

unique field-level exchange between desktop applications and Lotus Notes. These links redefine the way people and all their applications work together.

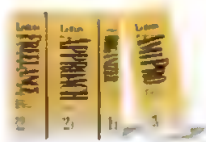
Today, SmartSuite continues to lead Microsoft® Office in many areas, including its

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So the choice is yours. Either see your local dealer, call 1-800-628-4777, ext. 9113 to order, or live a life full of danger and recklessness, running Windows without Norton Desktop 3.0 for Windows and sprinting around pools with sharp objects until you finally put somebody's eye out.

Of course, you would be absolutely crazy not to pick up your own copy of NDW 3.0 today. And remember, don't run Windows without it!

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CIRCLE 117 ON READER SERVICE CARD.

Trends

TRENDS & TECHNOLOGY SHAPING THE PERSONAL COMPUTER MARKET

The PC in Your Wallet

Smart cards are poised for mass consumption.

Smart cards—credit cards with tiny built-in microprocessors—have been making headlines recently, fueled mostly by President Clinton's talk of a National Health Security card. This technological concept is not new, but only now are smart-card applications

and hardware, such as smart-card readers that plug into PCMCIA slots, getting more attention.

A smart card can hold health insurance and frequent flyer records or driver's license and passport information. You name it. While the industry is in its infancy in the U.S., the French have been using 256-bit EPROM (erasable programmable read-only memory) phone cards en masse for years. Make your calls on a pay phone, then toss the card when your credit runs out (or keep it; people collect them like baseball cards). In Germany, 80 million people carry health cards that contain their health insurance information. At hospitals in Britain, patient records are stored on optical memory cards, which can store up to 6MB of X rays or MRI scans but have no on-board microprocessor like smart cards do.

A chip turns a plastic card into a multi-purpose super card and provides a key component essential for digital commerce: security. "We've been able to get enough computer power and security into a semiconductor device. There are chemical, physical, and electronic defenses that make our chip impenetrable," explains Walt Curtis of National Semiconductor. The company recently announced plans to build iPower, a portable PCMCIA security card with a 32-bit microprocessor, an on-board encryption engine, and up to 20MB of storage. This far exceeds the capacity of a conventional magnetic-stripe card, which holds only 75 bits of informa-

tion per inch (about 39 characters), enough for little more than a credit card number and PIN.

A smart card looks like any commercial credit card; it has the same dimensions and is made of the same durable plastic. But a smart card has a few high-tech extras. On the surface of most cards is a visible contact plate that enables the card and a card reader to exchange information (you don't "swipe" a smart card as you do a bank card). AT&T's 3K "contactless" smart card is designed to be especially rugged since the chip is completely enclosed within the card.

Motorola, SGS-Thomson, and Siemens all make the highly customized chip that measures about $\frac{1}{8}$ by $\frac{1}{8}$ inch. Inside are an 8-bit CPU, 3 to 64K of nonvolatile memory, and a miniature chip operating system that creates directories and partitions. And it's all thin enough to embed in a plastic credit card. "Except for a keyboard, display, and power source, it's as powerful as the original Apple computer," explains Dan Cunningham of GemPlus, a French smart card developer that opened a U.S. office in Gaithersburg, Maryland, in 1988. Its latest design is a pocket reader that slips into a PCMCIA slot. The smart card then slips into the reader.

"There are no real technical barriers to

be broken," says Cunningham of smart-card technology. "The challenge now is to put all the systems together." To get the travel agents and the airports, the insurance companies and the doctors' offices, the hospitals and the patients working together—that's the challenge.

The range of smart-card applications is as wide as you can imagine. AT&T envisions several cards evolving, explains Mike Jacobs of AT&T's smart card division. A smart travel card could hold digital airline tickets, hotel reservations, room keys, and phone cards. A health card could hold critical medical records and insurance information. An "electronic purse" card could serve as a combination bank card, credit card, and electronic checkbook. "There's no great demand for X rays on smart cards. You want emergency medical, prescription, and payment information," says Jerome Svigals, a smart-card consultant in Redwood City, California. Today, single-use smart cards are available. TeleSec of Clearwater, Florida,



makes a smart card that controls LAN access. And in France, banks have issued 20 million smart cards (the CP8s from Groupe Bull and Micro Card Technologies in Dallas) that hold digital cash.

So when will we all carry smart cards in our wallets? "Sometime within the next 18 to 30 months, but it could be sooner," predicts GemPlus's Cunningham.—Carol Levin

Pipeline By Robin Raskin

Games That Want It All

Okay, fellow gamers. Here's the ultimate challenge. Go out and buy four multimedia software titles. Try to install them all on your PC. I'll guarantee that at best you'll get two of the four to load without any problems. That's because each one was created in some sort of digital ivory tower, where misguided programmers never stopped to think that you'd want to have more than one program installed on your machine at once.

The ugly truth is that software games want it all. They want your memory—every last K of it—configured precisely the way they need it. They want to be right there in your CONFIG.SYS file. They want you to use a very specific set of peripherals, and in very prescribed ways. Worst of all, when you don't meet their demands, they hurl a series of pathetic error messages your way.

The biggest offenders are family and game software. I've seen programmers and MIS managers breeze through their days only to be brought to their knees in a night spent with their kids' computers.



The offenders are plentiful. Electronic Arts readily admits that it hasn't moved to Windows yet because its programmers have so much "control" under DOS. Most of the programs from Electronic Arts use well over 600K. I'm forced to unload my network card so the kids can play.

Software Toolworks' Super Mario Brothers needs 620K. The game won't get past the initial animation when running from the hard disk unless you kill the sound. If you set the direc-

tory to the CD to avoid this, the game starts up, but reports that it can't create a temporary directory on the CD.

Knowledge Adventure has great multimedia titles, but you never know what you're going to hear. One colleague of mine can hear the narration on his Dinosaur Adventure but no roars; I have the opposite problem. And I can't play more than the first syllable of Knowledge Adventure's Kids Zoo on my new 486 DX2/66 because of some incompatibility with the machine.

Upon installation, Media Vision's Quantum Gate informed me it couldn't locate my QuickTime movie player; my player should have been contained on the CD. Putnam New Media asked me whether I wanted to install the 16- or 256-color version of Big Anthony's Mixed Up Magic. I selected 16-color and was told that it wouldn't run because I needed a 256-color driver.

My kids complain that KidCAD is sluggish on our 486. Maxis's El-Fish won't work with EMM-386 when EMS is turned off, even though El-Fish doesn't use EMS. Battle Chess requires EMS. And programs like the ones from Binary Zoo that require expanded memory are simply out to lunch.

Some programs, such as Newsweek Interactive's Behind the Screens, require a VESA driver. Bailey's Book House won't run if you have Windows loaded, and Newsweek Interactive's Unfinished Business requires adjustments to AUTO-EXEC.BAT and CONFIG.SYS files. We can't find one system at *PC Magazine* on which it will install properly.

Home computing has become a nightmare. My own kids are turning into Luddites who say that it takes too long to "get their games running." They prefer our Mac Performa 550, where everything works. *PC Magazine's* editor-in-chief Michael Miller recently visited a friend who had to have separate boot disks for Rebel Alliance, Return to Zork, and 7th Guest. Steve Edelson, another *PC Magazine* friend, worries that his kids have lost their innocence since he's given them four different CONFIG.SYS files: normal, server, no CD-ROM, and Big Game.

The message is clear: To save our children and ourselves, game software developers need to drop their selfish "we want it all" attitude.

Robin Raskin is editor of PC Magazine.

Is It a Magazine or A Digizine?

GENERATION X IS ALIVE AND well and living on CD-ROM. For proof, read "substance. digizine," one of the first totally digital magazines to use CD-ROM as its paper. Based in San Francisco's Multimedia Gulch, where a tidal wave of interactive content is being created, "substance" is to magazines what Lotus 1-2-3 was to ledgers.

Unlike last year's CD-ROMs from *Newsweek*, *Time*, and CNN that transferred hard news from paper to electrons, "substance" is a digital lifestyle magazine created on computers for twentysomethings who were raised on computers. The digizine uses audio, video, text, graphics, and animation to present original articles. "We want to disprove the myth that multimedia is a fad," said Nick Roberts, cofounder of Substance Interactive Media.

Last year, *PC Magazine* issued an edition on CD-ROM that included benchmark test software that let you test your own PC and compare it with systems we tested. *PC Magazine* CD has a searchable index of a year's worth of articles, and many megabytes of test and demo files. The articles in "substance" are completely interactive and let you hear an interview as well as read it.

Using CD-ROM as a publishing medium also has its disadvantages. Distribution may become the biggest bottleneck because newsstands aren't equipped to stock CD-ROM magazines. Most of the CD-ROM magazines overcome this by selling subscriptions. (An annual subscription to "substance" is \$75 for 4 issues; 800-346-4080.) The company is also arranging bundling deals with magazines such as *Mondo 2000*, and with CD-ROM drive manufacturers.

Its creators started with two 486/33 PCs and used Macromedia's Authorware Professional to build the content, PC software to create and capture audio and video, and a Sony CD recorder to master the CD-ROM.

The first issue of "substance" will include articles on music, morphing, a contemporary filmmaker and more. The original music composed by the staff can be played on a PC and an audio CD player. "We also have an education agenda," said Roberts. "You don't learn anything if you're bored to death."—Christopher Barr

Dialing for Dollars The Nineties Way

IT'S TIME TO PAY THE MONTHLY bills again, but don't reach for your check-book. Turn on your PC, download this month's statement, transfer funds directly from your bank account to the credit card company, and keep an electronic record. This scenario isn't so farfetched now that Computer Associates, Intuit, MECA Software, and Microsoft are working to tie together PCs, banks, and credit cards.

Why hasn't home banking worked in the past? "The reason is twofold," explains Ridgely Evers, manager of on-line business services at Intuit. "Banks concentrated on the back end and offered un-user-friendly front ends. And home banking has been bank-centric, not consumer-centric."

That's starting to change this year as both Visa International and MasterCard International establish on-line access to their vast member networks. Together with Visa, Intuit plans to give "consumers the opportunity to capture all their financial relationships under one umbrella," explains Evers. "Electronic banking is not going to happen overnight. We're trying to create a system that will work for the banking industry and, therefore, for the consumer."

Visa's new electronic services will include intrabank fund transfers, electronic bill payment, and electronic delivery of credit card and bank statements. The pilot program starts this summer with a handful of major banks in the U.S. and Canada, including Meridian Bank and Wells Fargo Bank. The company's vision is to offer "a fully electronic, end-to-end bill-payment system," says Neal Waldo, senior vice president at Visa.

MasterCard is already closer to that vision. Its MasterBanking software, widely available in June, also connects customers to member banks. MasterBanking lets you make intrabank transfers, pay bills, and make

Top Retail Software		
Current ranking	Last issue	Product/company
1	1	MS-DOS 6.2 Upgrade Microsoft Corp.
2	—	TurboTax Final 1040 for Windows ChipSoft
3	4	MS Windows for Workgroups 3.11 Microsoft Corp.
4	5	Quicken 3 for Windows Intuit
5	8	MS Office 4.0 for Windows Upgrade Microsoft Corp.
6	10	MS Windows 3.1 Microsoft Corp.
7	—	Procomm Plus for Windows 1.02 Datastorm Technologies
8	—	QEMM 7.0 Quarterdeck Office Systems
9	11	OS/2 for Windows IBM Personal Software Products
10	—	WordPerfect 6.0 for Windows WordPerfect Corp.
11	16	MS Works 3.0 for Windows Microsoft Corp.
12	—	WinFax PRO 3.0 Delrina Corp.
13	—	TurboTax Saving Guide ChipSoft
14	—	Procomm Plus 2.01 Datastorm Technologies
15	3	Quattro Pro 5.0 for Windows Borland International

This list ranks PC business programs according to the total number of copies shipped to stores and resellers in the week ending January 21, 1994. The list is based on shipments to more than 12,000 retail locations. It does not include sales made directly by software publishers and cannot be interpreted as a picture of the entire software market. Sales information adapted from a compilation by Ingram Micro.

account queries from your PC. Future software will work on PDAs and interactive television. "What we are doing is devising a system that's device-independent," explains Glenn Santmire, senior VP of remote banking at MasterCard. And MasterCard has teamed up with CheckFree Corp., a leader in electronic bill paying, to provide electronic bill payment. At \$9.95 per month for up to 20 transactions, you can transmit bill-payment information to Check-Free's processing center, which will pay your bills electronically and deduct funds from your designated bank account. (Transfers still take a few days.)

Meanwhile, Microsoft is building alliances with regional banks across the country for a new ser-

vice that's bundled with Microsoft Money 3.0. Using Bank On-Line, you'll be able to make account queries and intrabank fund transfers. Pay On-Line (\$9.95 per month for the first 20 payments) is a separate service contracted to the National Payment Clearing House for electronic payment directly from users' participating bank accounts. —Melissa J. Perenson

Multichip Modules Pack Performance

MULTICHIP MODULES (MCMs), A technology developed for chip packaging, promise to add even better performance to high-end servers and workstations. By combining discrete bare chips into a single unit, MCMs reduce the interconnect distance between chips, which can significantly boost performance.

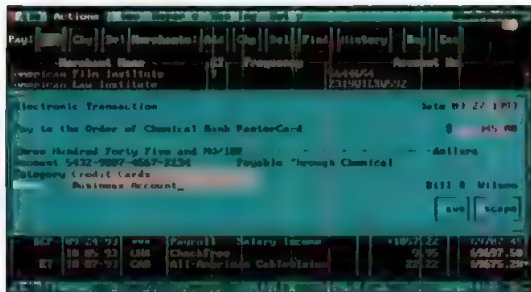
First used in supercomputers and military designs, MCM technology is finally making its way to the desktop. MicroModule Systems is developing a Pentium-based MCM that combines the Pentium processor with an SRAM cache and a cache controller. "Until recently, MCMs were unusually ferocious technology using exotic designs, but now system makers need only put a socket on the motherboard," says Howard Green of MicroModule Systems.

Green expects that his company's Pentium MCM will appear in servers, high-end desktops, and multiprocessor systems. By putting the chips on an MCM, which plugs into a socket on the motherboard, Green said, "You can get a higher clock rate [than with single-chip modules] because the MCM is a good environment for silicon."

Manufacturers see MCMs as a way to make the fastest computers even faster. NEC Technologies is developing an MCM using its 150-MHz VR4400 processor and 1MB of high-speed secondary cache. Jamal Haider, a product manager for NEC, claims that MCMs are necessary to get the best performance. "As clock speeds increase, you must keep the cache closer to the CPU," he says. NEC is designing the MCM for workstations that run Unix or Windows NT.

But why not put the processor and external cache on a single chip? "You could contaminate the cache if you put it on a single die," says Haider. Putting discrete chips in an MCM allows for testing of the parts and replacement of the bad chips.

—Christopher Barr



Teller-machine functionality in your home.

Videoconferencing On the Desktop

EVER FEEL AS IF YOU NEED TO BE in ten places at once? Now that the desktop videoconferencing market is taking off, you may be able to do it soon.

Telecommunications, networking, and compression are the big pieces of the videoconferencing puzzle, and companies are starting to cooperate to put that puzzle together. A whole new class of technical problems with pumping voice, video, and data over a network needs to be solved, but industry optimists say personal conferencing will be the killer app of the nineties.

Europe and Japan got a headstart in videoconferencing with the widespread availability of ISDN (Integrated Services Digital Network) lines that provide 128-Kbps and 1.5-Mbps connections for simultaneous voice, video, and data transfer over digital phone circuits. In contrast, ISDN in the U.S. is referred to as "It Still Does Nothing."

Intel, along with a dozen other companies, is spearheading a desktop-conferencing standard that would bring document sharing and videoconferencing to existing desktops. Intel has also organized a consortium of regional Bell operating companies and long-distance providers to bring ISDN to the desktop. With its new ProShare conferencing package (around \$1,200), you can display a video window of your colleague as you work together. ProShare comes with a camera, speaker, microphone, ISDN board, and video board. A software-only package (around \$100) lets you and a colleague

on your LAN collaborate on documents and share Windows applications.

There are still many items on the technology to-do list that companies such as AT&T, InVision, WorldLinx, Peregrine Systems, and PictureTel are also tackling. Video over the LAN is a shaky proposition because bandwidth—typically 10 Mbps—is shared. The more people on the network, the less bandwidth each person gets. With ISDN, there's no sharing; you own the circuit.

Multipoint videoconferencing (connect-

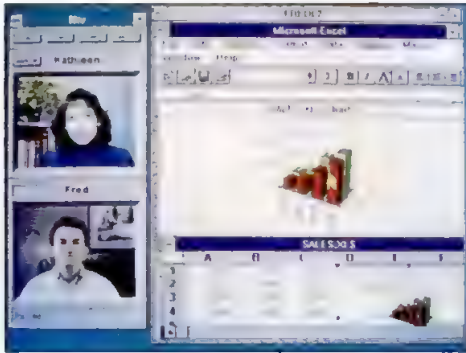
ing more than two people) is available today, but it's pricey, and there are architectural issues to contend with, such as how control is passed among participants. Other challenges are improving compression algorithms, synchronizing audio and video,

minimizing latency (jerky images), bridging LANs to WANs, and increasing the frame rate (10 to 15 frames per second is typical; your TV-trained eyes expect 30 fps).

The three most important words for the future of videoconferencing are asynchronous transfer mode (ATM). "ATM brings

together optimized bandwidth for real-time communications," says Intel technical marketing manager Tim Sweeney. ATM should deliver between 25 Mbps to 622 Mbps and eliminate the complications of connecting LANs in a WAN. The catch is that ATM requires a new caliber of infrastructure.

"Our goal by the year 2000 is for every PC to be a personal-conferencing PC," says Patrick Gelsinger, VP and general manager of personal conferencing at Intel. When that happens, maybe you really will be in ten places at one time.—Carol Levin



Step 1: Dial the phone. Step 2: Comb your hair.

Combo Chips

CONSOLIDATING THE FUNCTIONS of two chips into one is a guaranteed method of continuing the downward spiral of system prices. A new chip from AMD that combines a SCSI controller with an Ethernet networking controller is a prime example of the type of technological consolidation taking place. At least one of the top five PC vendors is signed up to use it already.

AMD's combo chip, aptly named PCnet-SCSI, is designed for the PCI bus and should allow system builders to combine a network adapter and a SCSI adapter for less than \$50, which is far less than using adapter cards.

Combo chips have been tried before without much success. A number of vendors had combination Ethernet and Token-Ring chips that allowed the system maker to choose the scheme it wanted to implement. But computer companies found these chips too expensive, and users often felt locked into a product not of their choosing.

As more core features such as video, networking, and SCSI controllers come preinstalled on the motherboard, another benefit to users of a chip such as PCnetSCSI is simplified customer support. Instead of having to call three different vendors if something goes awry, you need only make one call.

—Christopher Barr

Briefs

WORDPERFECT MARKS THE END OF AN

era. After 14 years of offering free, unlimited, toll-free technical support, WordPerfect has changed its policy. Registered users of its business programs receive 180 days of free, toll-free support. After that, calls cost \$25 "per incident" or \$2 per minute. Meanwhile, Digital is providing one-stop support for small-office/home-office users. Service-in-a-Box (\$99 per year) includes toll-free support for 450 PC and Mac apps, 24 hours a day, 7 days a week. Call 800-722-9332.

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kids. The new Missing Children Forum gives 1.5 million members immediate access to photos and information on missing children within an hour of receiving notification

from the National Center for Missing and Exploited Children. Type GO MISSING.

WIRELESS WONDER FOR BUSINESS

travelers. Official Airline Guides plans to deliver flight information over RadioMail to PDAs running General Magic's MagicCap operating system. Specify departure and destination cities, dates, and times, and OAG will send information on five available flights within 1 minute. Next: reservation and ticketing features.

VICE PRESIDENT AL GORE TAPPED INTO

his first electronic town meeting, which convened on CompuServe's U.S. News and World Report forum and drew a record 900 CompuServe members. Topic of discussion: the information highway.—Carol Levin

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ZEOS dual scan screen (left) fires up rich, vibrant colors while standard passive matrix screen (right) produces faded and dull colors. Photos are not retouched.

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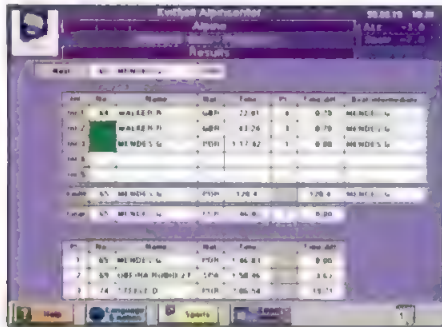




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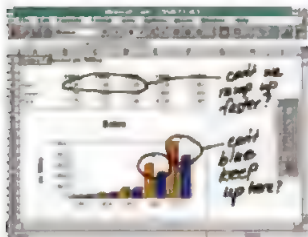
Lillehammer'94

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HANDWRITER FOR WINDOWS: WHAT YOU'VE ALWAYS WANTED

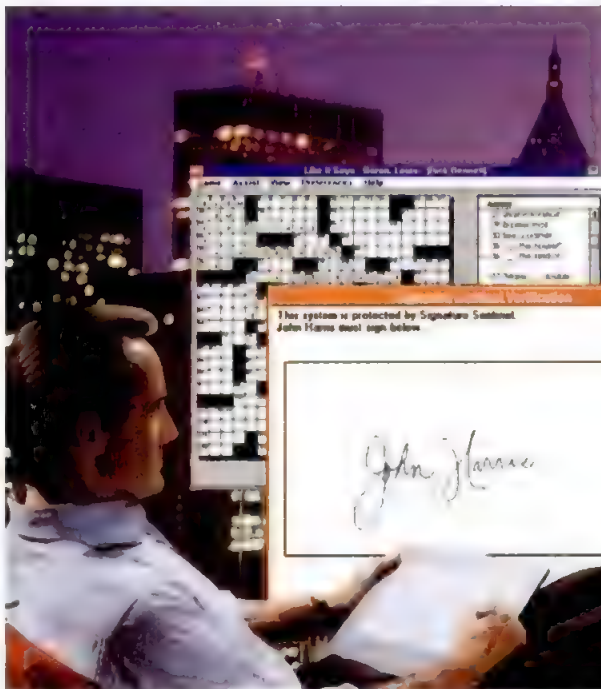
It's here: maximum synergy between your brain and your PC. We're proud to introduce Handwriter[®] for Windows, the all-in-one input device for entering graphics, text and commands. Point, write and draw as simply as with pen and paper. It's compatible with your favorite Windows applications and simple to install.



Shown above is handwritten annotation to a spreadsheet. Each member of a workgroup makes their annotations in uniquely colored ink. A pen is such a perfect complement to your keyboard, you'll probably never use a mouse again — in your whole life.

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“[Handwriter] accepts human handwriting in a way that runs circles around Newton, Zoomer or EO.”
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First Looks

HANDS-ON REVIEWS OF NEW SHIPPING PRODUCTS

■ Two Small-Business Solutions

M.Y.O.B. 4.0 and DacEasy Heat Up Windows Accounting Fray

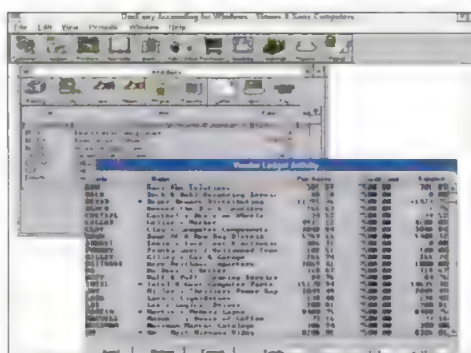
BY THERESA W. CAREY

The latest offerings in small-business accounting come from longtime participants Best!Ware and DacEasy. Best!Ware has upgraded M.Y.O.B. Accounting with Payroll to Version 4.0, while DacEasy has put most of the functionality of its decade-old DOS product into its first full-function Windows product.

Both programs have impressive features built in, including contact management, flexible reporting, customizable forms, and payroll processing. Both also arrived too late to be tested for *PC Magazine's* recent small-business accounting roundup ("Windows of Opportunity," January 25, 1994).

DACEASY'S CHALLENGER

The \$149.95 DacEasy Accounting for Windows shows that DacEasy is on the right track, but it still has a mile or two to go. This program is much more than just a Windows port of the DOS version, but at the same time, it leaves out several functions.



EASY ACCESS: DacEasy's vendor activity report is two mouse clicks from the main menu.

Navigating from the toolbar is simple: You click on a button, such as Vendors, and another toolbar pops up. You can set up defaults for many of the basic transactions (such as entering customer records), which helps you avoid repetition.

DacEasy sepa-

rates sales orders from invoices, which can be a little confusing. Sales orders work like quotations, generating a report for your information but not affecting your general ledger. The process of converting an order into an invoice is what creates financial transactions. DacEasy allows items in inventory to be committed to individual sales orders, and those items can be released back to the general inventory pool if necessary. When you use the Invoices module, sales orders are displayed along with the current invoices, though you can only convert orders to invoices in the Sales Order module.

Curiously enough, recurring transactions are not built into

Continues on page 38

■ Document Storage on a Whim

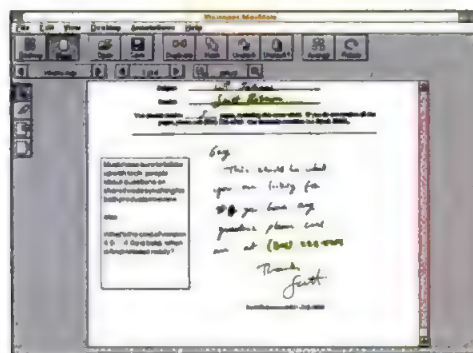
PaperMax: One Scan Closer to Paperlessness

BY GREG PASTRICK

Are you faced with the same mass of paper every day: this morning's faxes, yesterday's phone messages, newspaper clippings, memos, expense reports? What's the easiest way to pass along, pitch, or properly store everything? Visioneer's \$499 PaperMax, which includes the PaperMax scanner and

MaxMate software, is a simple, efficient system for pushing paper along a digital path to the right people and places. PaperMax does this through direct links to the most common business communications tools around: e-mail and fax.

Far more than a cure for the cluttered desk, the scanner and software give you a nearly plug-and-play hardware setup along with a virtual desktop to collect, process, file, and distribute documents and images. The price of the package allows unlimited distribution of the MaxMate file-format viewer, so DOS, Win-



DOCUMENT DETAILING: MaxMate lets you dress up image scans with annotations.

dows, and Macintosh platforms are all covered. (The viewer is also available on America Online and CompuServe.)

SERIOUS SOFTWARE SUPPORT

Software support for popular e-mail and OCR (optical character

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Accounting

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this version, though you can create macros to run them if necessary. There are keyboard equivalents for most of the commands, so a speedy typist doesn't have to use the mouse. Report preparation has been significantly streamlined from the DOS version, with custom reporting in each module, but the font selection is limited.

Some areas of the program appear to have typical first version problems; for example, some field input lines are larger than the allowable text. DacEasy doesn't supply a data-import feature for those who want to switch over from the DOS version, though one is promised in a soon-to-be-released maintenance upgrade.

MINDING YOUR OWN BUSINESS

M.Y.O.B. has a Macintosh heritage, and it shows up in an interface that depends heavily on mouse clicks. The main menu, called the Command Center, displays a "road map" that shows how the functions within each module are interrelated. The interface is so graphical that it will either delight or frustrate you with its rigorous reliance on icons and pictographs.

The \$199.95 program has more to offer than just a set of accounting tools; it also strives to help you automate your business management through tools on its to-do list. This feature keeps track of a number of tasks, including receivables and payables that are due or overdue; it reminds you to run your recurring transactions; and it gives you a push to check over your pending sales and purchase orders. If you're using the contact management capability, the to-do list will tell you

whom you are scheduled to call as well.

Since M.Y.O.B. shows the results of each transaction as soon as it's saved, the setup procedure gives you the choice of being able to edit a transaction if you need to make a change or having to make a reversing entry. The latter more closely reflects accepted accounting procedure, but the ability to edit previously entered transactions makes the program much more friendly. Some of the other useful touches are a link to Timeslips, the well-known time-billing package; modem control for automatic phone dialing; and the ability to schedule invoice and purchase order printing.

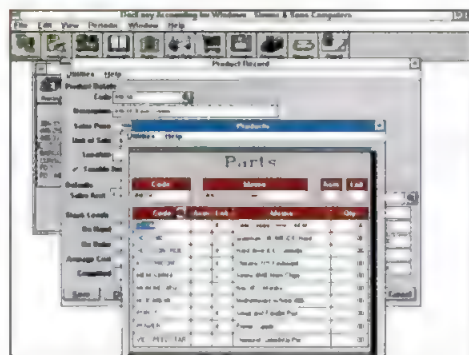
M.Y.O.B. uses a card-file metaphor for storing data about people and companies. Employees, customers, vendors, and personal contacts are kept in a single file. A nice touch here is that you can enter more than one contact name for customers and vendors. M.Y.O.B. generates form letters, faxes, and mailing labels from the card file.

The sales and purchase modules allow for pending transactions (sales orders, purchase orders) and provide both text and graphical analyses of your company's income and expenses.

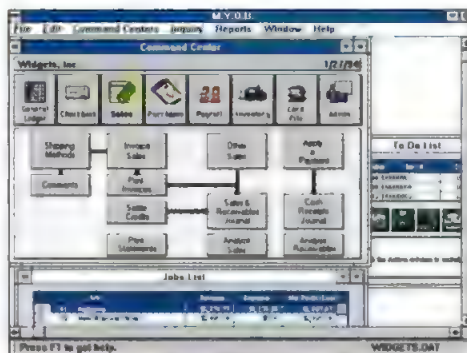
There are some screens—especially the various pick lists—that are difficult to read at resolutions higher than 640-by-480, so you may have to reset your Windows options in order to see the fine print.

PAYROLL PLUS

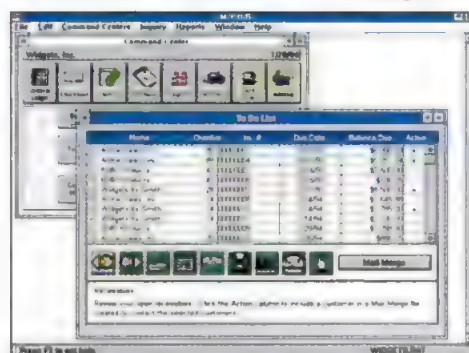
As with Peachtree Accounting for Windows, both DacEasy and M.Y.O.B. include complete payroll process-



INVENTORY: DacEasy has product assembly in its inventory module.



ICON MANIA: M.Y.O.B.'s Command Center brings push-button access to all of the program's modules.



REMINDERS: M.Y.O.B.'s to-do list shows you pending activity in nine different areas.

ing. M.Y.O.B.'s payroll is completely integrated with the general ledger so that payroll checks are included in the company's financial reports as soon as they're printed. DacEasy's payroll asks you to go through a posting routine before the general ledger is affected.

Both payroll programs are fairly easy to configure, though some advance organization on

your part—especially categorizing various types of earnings and deductions—will make the setup process go more smoothly.

Neither one of these two programs can do full back-order processing (although DacEasy handles it in its DOS version). M.Y.O.B. lets you create a pending invoice if you don't have enough in stock, and DacEasy lets you set up a sales order that you can later convert to an invoice, but like the other Windows accounting programs in this price range, a back-order feature is left out. M.Y.O.B. does let you put an entire invoice into the Pending file if you don't have enough of a particular item.

Compared with M.Y.O.B., Version 4.0, DacEasy Accounting for Windows 1.0 is less polished, though its screen menus are clearer and easier to read than M.Y.O.B.'s and the basic design of the program is very sound. Faithful users of DacEasy's DOS version will find a number of helpful improvements, but the current absence of a data-conversion facility will slow down the changeover.

- List price: DacEasy Accounting for Windows, \$149.95.

Requires: 4MB RAM, 2MB hard disk space, Microsoft Windows 3.1. DacEasy Inc., 17950 Preston Rd., Dallas, TX 75252; 800-322-3279, 214-732-7500; fax, 214-250-3752.

Circle 425 on reader service card

- List price: M.Y.O.B., Version 4.0, \$199.95. Requires: 4MB RAM, 6MB hard disk space, Windows 3.1. BestWare, 300 Roundhill Dr., Rockaway, NJ 07866; 800-322-6962, 201-586-2200; fax, 586-8885.

Circle 426 on reader service card



From March 14 through March 18, you can go on-line to discuss small business accounting with Theresa Carey, DacEasy VP of development Allan Walker, and M.Y.O.B. product manager Kurt Gebaur. Type GO EXEC from any CompuServe! prompt.

PaperMax

CONTINUED FROM PAGE 37

recognition) packages, along with fax and printer drivers, open up options beyond the simple scanning and saving methods of document management. MaxMate seamlessly links your scans to local and network software and devices.

Working from the MaxMate desktop, you can attach scanned files to e-mail messages. You can then print them, fax them, or process text scans through OCR software by simply dragging and dropping your scans on the icons that represent those different functions.

MaxMate supports Lotus Notes and cc:Mail, DaVinci eMAIL, Microsoft Mail, Caere's FaxMaster and Intel's FAX-ability faxing software, and both Caere and Calera's lines of OCR software.

ANNOTATE YOUR SCANS

Not only can you send captured images to installed applications and hardware, but you can also annotate, attach notes to, and highlight text in the scans you capture.

Here lies MaxMate's real strength. With annotations, you can add text and highlighting directly to captured image files. The program's sticky-notes feature gives you a text box that you can collapse, expand, and position anywhere in the image. What's more, MaxMate lets you group documents into multipage stacks and save them in the native MaxMate file format under a single filename.

The package has an effective cleanup feature, which despeckles images to give them a clean paper-white appearance regardless of the original paper stock (including newsprint and glossy papers). Image editing is limited to the cut, copy, and paste of MaxMate annotations, however.

For the most part, Visioneer executes the desktop metaphor effectively, but MaxMate has some serious limitations. Image manipulation from the MaxMate interface is restricted mostly to rotating and zooming scanned images. MaxMate also lacks the most rudimentary drawing tools. There's no erase or image-cropping feature, and it's missing other basics such as an undo feature and the ability to copy to the Windows Clipboard.

Though you can export scans to .BMP, .PCX, TIFF, and Macintosh Pict file formats, any special effects, such as annotations and image stacking, are lost when scans are saved and closed to file types other than MaxMate's native format. Even so, when a file of any supported type is opened to the MaxMate desktop, all of the file's native features are accessible. MaxMate also inverts images when you export scans to .BMP format. Though it looks fine on the MaxMate desktop, you'll find it inverted if you look at it with another program.

EASY HARDWARE SETUP

Setting up PaperMax is simple. All you have to do is plug the scanner into an open serial port and run the short Windows setup routine from the MaxMate

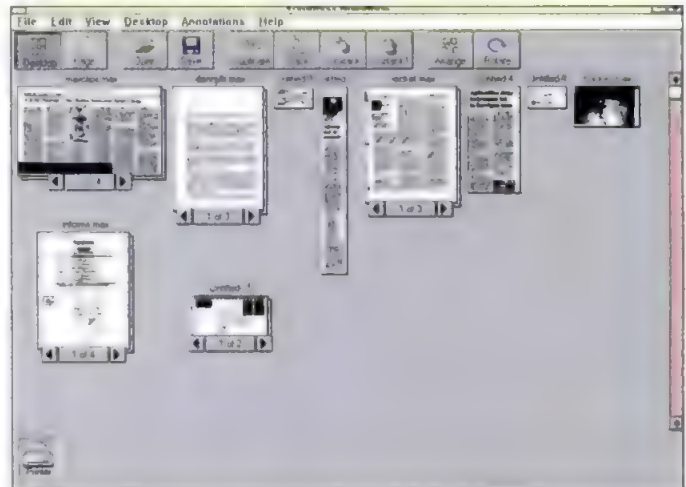
forms and multipage documents. Virtually anything up to 8.75 inches wide and 30 inches long that's important enough to scan, store, or send to another reader can be scanned.

WELL FED

In order to test the scanner, we fed it business cards, photographs, long newspaper clippings, notes, receipts, Federal Express forms, newsletter pages,

depths, the image quality is good only as a visual reference. Even so, the picture scans capture enough detail to make the picture-file sizes twice as large as text captures (an average text page creates a 35K file). Software controls for the scanner allow you to adjust for brightness and do automatic deskewing of images.

In spite of its software shortcomings, the PaperMax docu-



DESKTOP ORGANIZATION: A desktop view of captured documents and images show the variety of scan-source types the PaperMax handles. Notice the multipage document stacks, too.

mentos, faxes, train schedules, photocopies, envelopes, and letters. The scanner handled all of them without mangling them or jamming its paper-feed mechanics.

All that you have to do is insert the original between the plastic guides and the paper-driven scanner will take over. MaxMate launches automatically as the scanner passes the original along either a straight or curved paper path (your choice), capturing

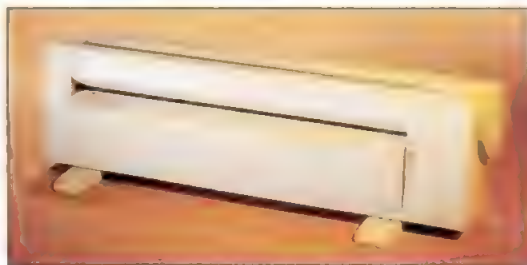
pictures and words at 200-by-200 resolution in text or photographic mode.

The speed of the scanner is as remarkable as its unobtrusive size and design. You have a choice of pattern effects or diffusion halftone effects for photograph scans, but at 1-bit pixel

ment and image management system has real potential. MaxMate's desktop metaphor, the functional links to communications applications and hardware, and the OCR hooks for editing and processing text from a variety of sources are well matched to the streamlined, fast-capture scanning hardware. Not only will it put clipped and ripped printed treasures into a digital format you can deal with easily, it'll also help you get papers off your desk and put them where they really belong—on someone else's.

• List price: PaperMax, \$499 (includes PaperMax scanner and MaxMate software). Requires: 4MB RAM, 4MB hard disk space, serial port, Microsoft Windows 3.1. Visioneer, 2860 West Bayshore Rd., Palo Alto, CA 94303; 800-787-7007, 415-812-6400; fax, 415-855-9750.

Circle 428 on reader service card



NO ON SWITCH: The automatic paper-driven scanner is unobtrusive and relatively fast.

installation disk.

The long and lean 2.5-pound scanner, which stands 4 inches high and a little over 12 inches wide and is meant to sit right in front of your monitor, scans a variety of source materials—from scribbled note scraps and newspaper clippings to full-size

■ Modem Preview

AT&T DataPort 2001: Voice and Data Travel Together

BY ANGELA GUNN

As children, we all loved show-and-tell day at school. Of course, now there's nothing quite like that sinking sensation you get when the person at the other end of the phone line can't envision the thing you're trying to describe. "If I could just show you this..." is a plaintive, fruitless phrase, and even fax machines can't help when you and the other person are trying to hash out details and make changes in real time.

The \$549 AT&T DataPort 2001 modem carries you back to the good old days of show-and-tell. The modem has both 14,400-bps fax and data support, and it also offers simultaneous voice and data communications through its AT&T VoiceSpan technology.

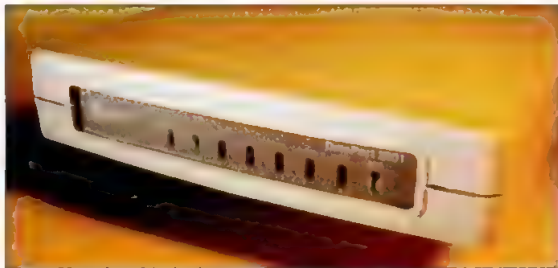
The result is that you can talk to a person and compute with them at the same time and in real time. Of course, if you have two phone lines, one for your modem and one for your phone, this is no big deal. But for people with only one phone line, it can be a real productivity enhancer. In reality, the implications of VoiceSpan technology may be more exciting for the future than they are for the present (see "VoiceSpan Everywhere?").

This kind of ISDN-like splitting of one phone connection into two channels has already been done by the MultiTech MultiModem, which uses an earlier version of the AT&T chip set as well as the DataBurst

method of sending voice and data packets on one line. But AT&T's modem is software-independent, and after initial trouble starting it up we were highly pleased with the quality of both voice and data connections.

ROCKY START

Our tests of the DataPort 2001 prototype we received got off to a rocky start: Though the data-only connection worked beautifully, the voice/data connection didn't work at all. AT&T tech support made AT-command



DOUBLE TALK: One line, two channels.

string recommendations that cleared up the problem. Once connected, we were able to initiate and receive voice calls during data sessions, and vice versa. In all cases, data speed dropped from 14,400 bps to 4,800 bps and voice quality was reduced very slightly, but the levels of both were nonetheless quite acceptable.

DYNAMIC SPEED CHANGES

The modem is designed to negotiate connection speeds dynamically. When no one is speaking, the data rate goes up, and when no data is being transmitted, voice quality improves. (Again, voice quality is very good—an improvement to a problem that

kept earlier modems from wider acceptance.)

We tested a variety of software and found that as long as we were meticulous about entering the proper AT commands at the start of a session, all was well. The modem is available with QuickLink II modem/fax software and DataBeam Corp.'s FarSite whiteboard package. FarSite lets users sketch to each other in real time, providing a means of working out difficult visual concepts or sharing clever doodles.

The modem itself is smaller than some of AT&T Paradyne's previous offerings, measuring about the size of the classic Hayes modems. But a few good features have been lost. Fans of the older modems' LCD panels will miss them. Instead, you're confronted with the usual eight status lights.

In most respects this modem strongly resembles the earlier AT&T DataPort 2000. It supports the usual V.32bis, V.42, and V.42bis data standards and the usual Group III and Class 1 fax specifications, along with V.17. AT&T Paradyne ETC error correction is included for cellular calls. The 2001's firmware is also remotely upgradable by calling AT&T's Paradyne bulletin board.

ON BOTH ENDS

One of the critical issues with proprietary technology such as this is making sure that it's on the desks of the people you need to reach. Both parties' modems must support VoiceSpan to have simultaneous voice-data connections, so for the present, that will put a damper on the potential appeal of the modem. AT&T is already working with companies such as Canon, Matsushita, and Sega to ensure that you can play show-and-tell with anyone. The company estimates that VoiceSpan will be

available in all AT&T products by the end of 1994. Meanwhile, if you find yourself saying "If I could just show you..." to associates also looking for a fast, dependable modem, the AT&T DataPort 2001 is exactly what you need.

• List price: *AT&T DataPort 2001*, \$549 (\$469 without software). Requires: any standard telephone for voice calls; serial port. VoiceSpan also requires that both modems have VoiceSpan technology. AT&T Paradyne, 8545 126 Ave. N., Largo, FL 34649; 800-554-4996, 813-530-2000; fax, 813-530-2103.

Circle 424 on reader service card

■ VoiceSpan Everywhere?

If all goes as planned, modems won't be the only place that VoiceSpan technology shows up. AT&T wants to put a VoiceSpan chip in all your electronic equipment, stating that VoiceSpan "will be like 'Intel Inside' or 'Dolby'" as a standard for new equipment. At the Consumer Electronics Show in January, AT&T and Sega debuted the EDGE 16 interactive game module, which lets players compete over a phone line and talk as they shoot.

VoiceSpan technology takes outgoing signals and breaks them into voice packets and data packets, all of which move over the same channel. The modem at the other end sorts them out and sends them to the right place. Matsushita, one of AT&T's VoiceSpan partners, controls several product lines including Panasonic and Quasar, so VoiceSpan could one day turn up in your television or stereo equipment, too. —AG

"They Can Network Me.

Make Me Interactive.

Even put Me

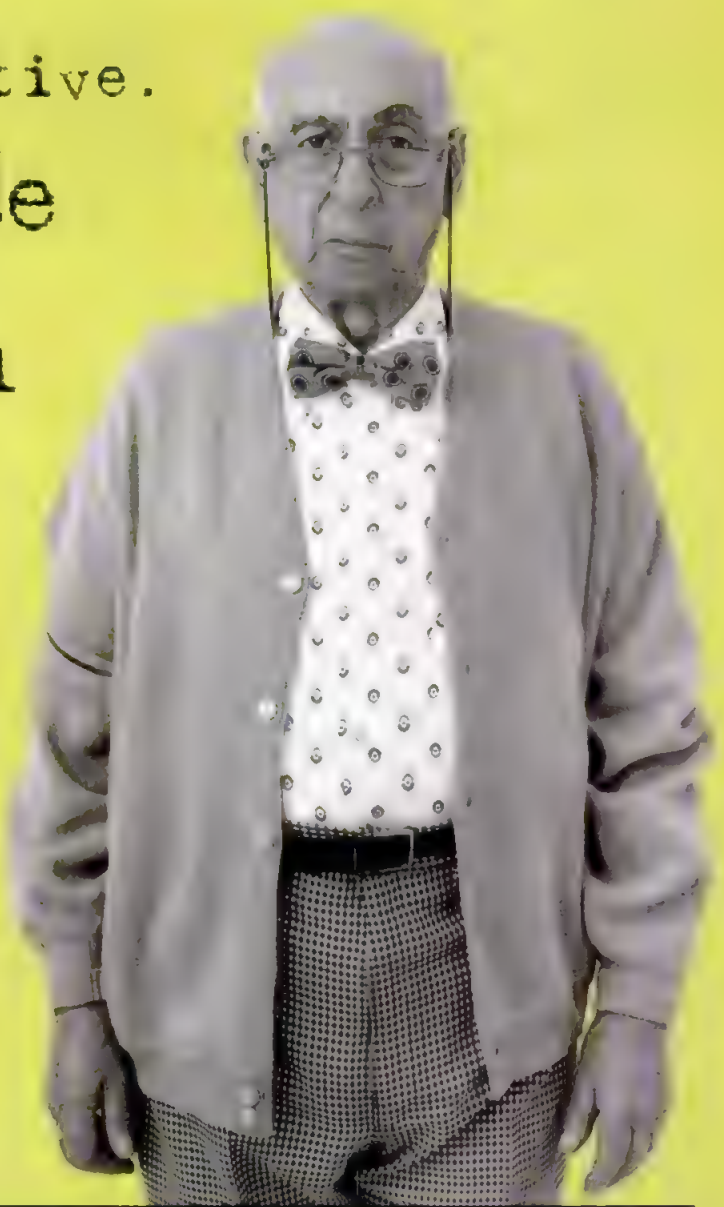
On Some Digital

Expressway. Can't

Someone just

Cure My

Scanaphobia?"



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Canon

Printers

Lexmark WinWriter 600 Is First To Have Microsoft At Work

BY BRUCE BROWN

Windows users tired of waiting for their printers to finish long printing jobs—especially graphics printing jobs—will find the \$1,399 Lexmark WinWriter 600 a faster solution.

Developed as a joint effort between Lexmark International and Microsoft Corp., the printer, which includes Microsoft printer-control software, is very fast in Windows mode and extremely easy to use. The WinWriter 600 is controlled entirely from your PC.

Like the Hewlett-Packard LaserJet 4M (its main competitor), the WinWriter 600 is an eight-page-per-minute laser printer with 600-dot-per-inch resolution. The printer is equipped with enhanced resolution technology, which Lexmark calls PQET (Print Quality Enhancement Technology). The greatest edge the WinWriter 600 has over the LaserJet 4M, and all other current printers, is that it's the first printer to be based on Microsoft At Work printing software, which is what adds the speed and convenience.

Once you install the Microsoft Windows Printing System, you'll hardly touch the printer again, except to add paper, change the toner cartridge, and retrieve your output.

NO MORE BUTTON PUSHING

You control all printer settings from your PC when the WinWriter 600 is the selected local Windows printer. Instead of the relatively sparse Print Control dialog box that pops up during regular Windows printing, the

Windows Printing System gives you a graphical representation of the printer, complete with animation that shows how each page moves through the printer during the print job.

You also see a job-completion progress bar and estimates of the print time remaining, as well as the expected completion

time. You can select landscape or portrait mode, choose individual pages to print, and sort pages in collated or noncollated order.



DON'T TOUCH: New software for on-screen control.

Just about every print option is on the Windows Printing System screens, including options for choosing paper source, resolution (300 or 600 dpi), print darkness, and for enabling the curve-smoothing PQET. When you select gray scales, you can preview the various effects on-screen. Other settings let you scale images from 10 to 400 percent and select print-job header and trailer sheets.

The WinWriter 600 has configurable power-down capability, but the printer automatically powers down after 30 minutes from the last print job.

Manual duplex printing is a convenient option for document print jobs. If you select that mode, odd-numbered pages are printed first and then you reinsert the pages into the input tray

to print even-numbered pages on the back. You can even print out a duplex printing guide sheet that will show you how to reinsert the paper. Watch out for paper jams, though, because you'll have to start over.

While the WinWriter 600 is working, optional voice messages speak up to tell you the printer status, give you job feedback, and offer troubleshooting information. The 10.5- by 14.25- by 14-inch (HWD) WinWriter 600 weighs 34.5 pounds. With a single-sheet input tray and rear exit tray installed, the unit is 27 inches deep. The standard paper tray holds 200 sheets, and the output tray holds 100 sheets. Several paper-handling options are available.

The WinWriter 600 has an upgradable 16.67-MHz 68000 CPU, and the standard 2MB memory can be increased to a maximum of 8MB. The printer

uses PCL 4 emulation for DOS printing jobs, and you'll find HP code detection and six PCL fonts. Forty-four included Windows TrueType fonts combine with Windows' own 14 TrueType fonts for a total of 58 fonts.

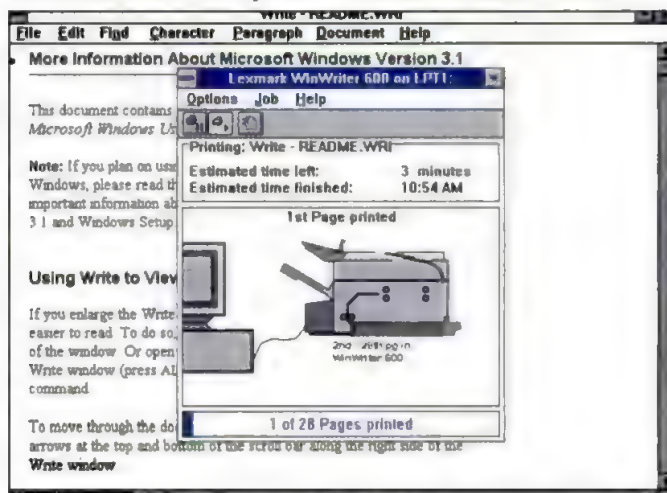
SPEED ADVANTAGE

The WinWriter 600 has a speed advantage because the software uses your PC's CPU and RAM to process print jobs. It sends print codes directly to the printer from Windows, so there's no need for time-consuming code conversion or translation. In the course of our testing, the WinWriter 600 handily outperformed the HP LaserJet 4M. In 600-dpi mode, it ran at 1.29 graphics pages per minute on our CorelDraw test, 2.5 gppm on our Lotus 1-2-3 test, and 6.5 ppm on our Word for Windows test.

With its excellent performance, fair price, and convenient computer-based printing control, the WinWriter 600 is a strong choice for Windows printing. It's not meant for networks, but individual Windows users in the market for a new printer should give it a good look.

• List price: Lexmark WinWriter 600, \$1399; Lexmark International Inc., 740 New Circle Rd., Lexington, KY 40511; 800-358-5835, 606-232-2000.

Circle 434 on reader service card



PRINTER CONTROL: While executing a print job, the Windows Printing System displays a status screen.

Get a Newton.

Get a Pager.

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Mathematics

Mathcad 5.0 Divides Itself To Conquer Math Market

BY BARRY SIMON

What do you do when you already control a majority share of a market? You try to broaden the market. That's precisely what MathSoft has done with Version 5.0 of its Windows-based math program, Mathcad.

Mathcad 5.0, \$99.95, is easier than ever to use, and the \$299.95 Mathcad Plus, a superset, has extras such as souped-up symbolics and differential equation solvers. Almost all of the Mathcad 4.0 feature set is retained in the standard 5.0 version. The most notable tools reserved only for Mathcad Plus are SmartMath and support for add-on function packs (although handbooks work with the standard version).

LIVE FORMULAS

The basic interface is still the one that originally made Mathcad so popular. You work in a blank space with live formulas that are updated as you change the values of variables. These formulas can include much more than simple arithmetic: There are all kinds of special functions, equation solvers, numeric integration and differentiation.

Symbolic math functions are also included, but in the standard version, you must update them by hand. You will also find two- and three-dimensional plotting, but you won't find a programming language.

For longtime users of Mathcad, the biggest improvement in usability is in editing. In Version 5.0, formula editing works much like a word processor, a neat trick since the formulas need to be checked for syntax.

For new users, there is a clear, attractive tutorial and a "How Do I" menu item that will get you through the basics (but not the more advanced features) rapidly. Throughout, informative messages on the status bar

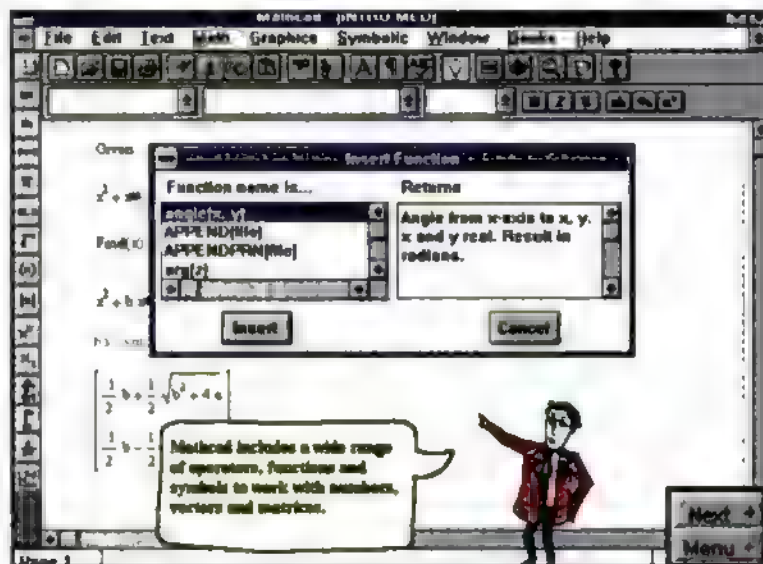
matrix editing that makes the matrix look like a spreadsheet.

IMPROVED GRAPHICS

There are two major additions to the graphics engine, which already supported multiple func-

tions, line and bar plots, polar plots, contours, and surfaces. First, there's a zoom view for two-dimensional graphs. You can draw a rectangle on the graph and zoom in so that the rectangle fills the space taken by the original graph. Second, a cross-hair grid lets you click on a point and find its coordinates.

The new zoom does not work if you have set a log scale, and you have to set the grid size by hand. And there is still no way for you to adjust the viewport for three-dimensional graphs the way you that you can in other popular high-end mathematical packages.



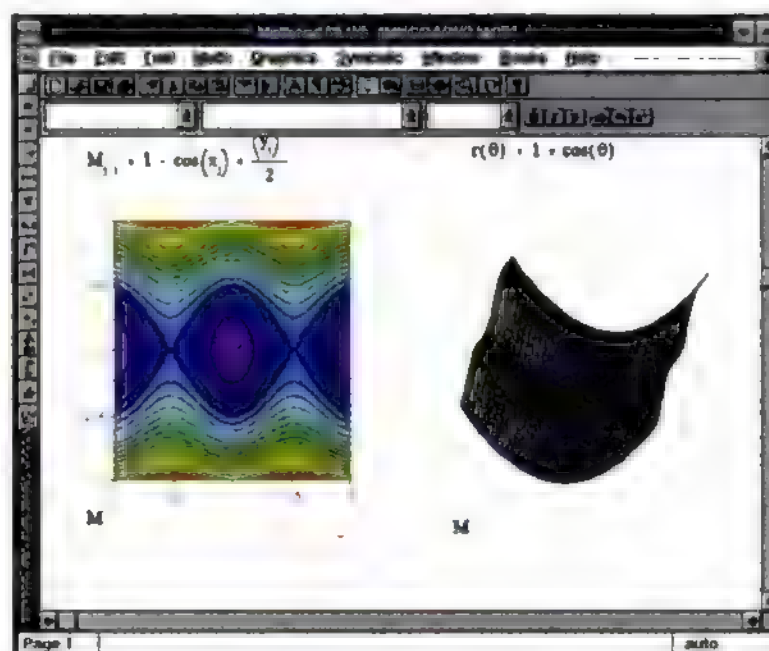
ATTENTION CLASS: Mathcad has a new tutorial starring a tweed-clad professor.

make navigating the program a pleasure. A pop-up list of functions is also new.

Mathcad has long been the best math package for producing good-looking output. Version 5.0 adds a spell-checker, page setup, and print previewing to the font support it had in Version 4.0. These features are useful additions but fall short of what you find in a major word processor (for example, the print preview has no zoom and isn't editable). The spell-checker knows many scientific terms and names that would trip up less specialized products.

OLE CLIENT

Since Mathcad is now an OLE client, you can easily embed graphics; however, it doesn't support OLE 2.0 in-place editing. Also new to this version is curve fitting with linear parameters and a mode of



PLOT THICKENS: Mathcad's improved graphics include contour and surface plots.

ADVANCED VERSION

Mathcad Plus has more high-end functionality, much of it involving access to more math functions. You can buy add-in packs

from MathSoft, including a new set of functions that are taken from Cambridge University Press's celebrated book *Numerical Recipes*. You can also write your own functions in C and use a suitable 32-bit compiler to make your own add-ins.

The Plus version includes 13 differential equation solvers, a nonlinear curve fitter, 20 advanced matrix functions (including singular values and QR decompositions), 6 new symbolic transforms (including Laplace and Fourier) and symbolic limits. SmartMath, which was first introduced in Mathcad 4.0 and is now found only in the Plus version, makes symbolic calculations live. Mathcad Plus's ability to handle series symbolically in more than one variable is new as well.

While Mathcad Plus is high-end when compared with earlier versions of Mathcad, it lacks the programmability and thousands of routines that continue to make Macsyma, Maple, Mathematica, or Matlab the program of choice for users with really sophisticated needs. You'll still find it necessary to turn to those super-powerful programs to handle your most complex math problems.

Current MathCAD users will want to get the upgrade for the extra functionality and ease of use that it provides, and anyone who needs mathematical power but does not need programming will find MathCAD the program of choice.

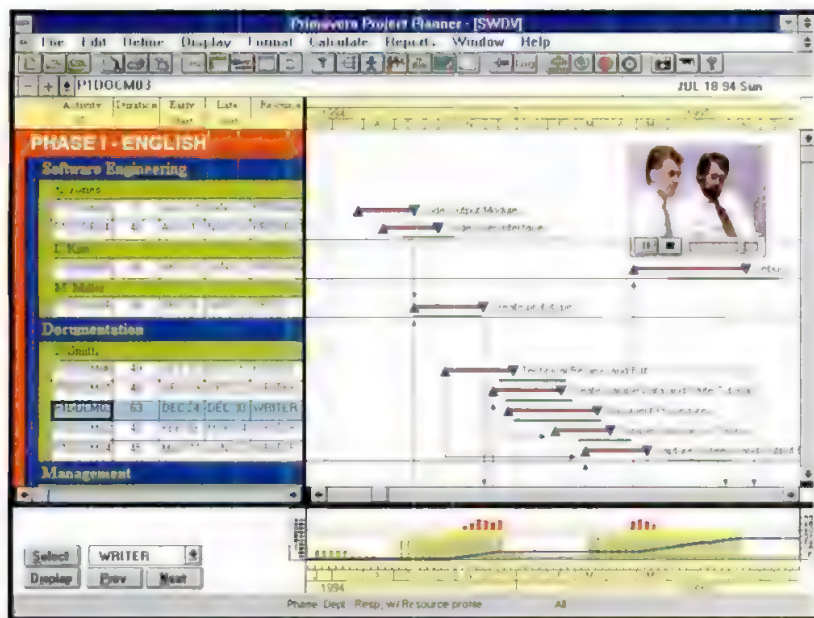
- List price: *Mathcad, Version 5.0*, \$99.95; upgrade, \$49.95; *Mathcad Plus*, \$299.95; upgrade, \$149.95. Requires: 4MB RAM (8MB for Mathcad Plus), 8MB swap space, 14MB hard disk space (16MB for Mathcad Plus), Microsoft Win-

dows 3.1. MathSoft Inc., 101 Main St., Cambridge, MA 02142; 800-628-4223, 617-577-1017; fax, 617-577-8829.

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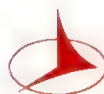
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Fonts

FontFiddler Adjusts Kerning But Won't Wreck Fonts

BY EDWARD MENDELSON

FontFiddler is the only utility that gives you exact control over your Windows fonts without degrading their quality. Ares Software's \$99.95 package is an efficient tool for users who aren't graphic artists but who want to be able to change the names that appear on Windows' font menus and modify the fine adjustments called "kerning" that tighten or loosen spacing between characters.

FontFiddler works with both TrueType and Type 1 font for-

ats. In contrast to full-fledged font editors like Altsys's Fontographer or Ares's FontMonger, FontFiddler doesn't convert fonts into a special format for editing, which means that FontFiddler won't disturb the original character outlines and the "hints" added by the original designer to improve output at small sizes.

When you open a font in the program's editing window, it displays a text string with small square "handles" between each character. By clicking on a handle, you can edit or create a



KERNING: FontFiddler is the only utility that lets you edit TrueType kern pairs directly.

kerning pair that adjusts the spacing between the characters on each of side of the handle.

If you work with fonts that have no kerning built in—like many of those sold by Microsoft—FontFiddler lets you import kerning data from other, similar fonts, or use one of the files of generic kerning data that comes in the package. You get only rough-and-ready results by using kerning data from other fonts or from generic kerning pairs, but it's almost always better than no kerning at all, especially when you print at large sizes.

FontFiddler's other functions include the ability to change the names that Windows uses when listing fonts on its menus and the ability to create or modify "font families" so that you get the font you want when you press the Bold button in your word processor.

Among dozens of font utilities on the market, FontFiddler has a unique balance of power and restraint. It lets you improve and customize your fonts, but it won't let you damage the original design.

• List price: *FontFiddler*, \$99.95. Requires: 12MB RAM, 1MB hard disk space, Microsoft Windows 3.1. Requires Adobe Type Manager if used with PostScript Type 1 fonts. Ares Software Corp., 565 Pilgrim Dr., Suite A, Foster City, CA 94404; 800-783-2737, 415-578-9090; fax, 415-378-8999.

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Utilities

Alki Seek Finds Files in Big Data Piles

BY BARRY SIMON

If you've ever had to find a single word buried in a huge mass of data, you'll appreciate Alki Software's \$70 Alki Seek for Windows, the first Windows version of a search utility that is already popular on the Mac.

Like The Norton Desktop's SuperFind and PC Tools' SmartFind, Alki Seek gives you a list of files that match your given specifications (text string, date, and so on). Then you can view, copy, move, or delete the matching files.

But Alki Seek goes much far-

ther in many ways. You can make indices for speedy access to files, and the program shows the search criteria in plain English. It will also search inside files compressed by PKZIP. You can type in the specs you're looking for or go through dialog boxes that help you build sophisticated Boolean searches or "sounds like" searches.

You can also speed up searches by creating indexes of the data on your disk. Alki Software estimates that those indexes are about 2 percent of the size of the files you're indexing, but in our tests, they were

even smaller: 7,500 files taking up 400MB took about 3 hours to index (on a 66-MHz 486 system) and produced a 2.5MB index.

An indexed search is speedier: It took just 20 seconds to find a file within that 400MB of data. Unfortunately,

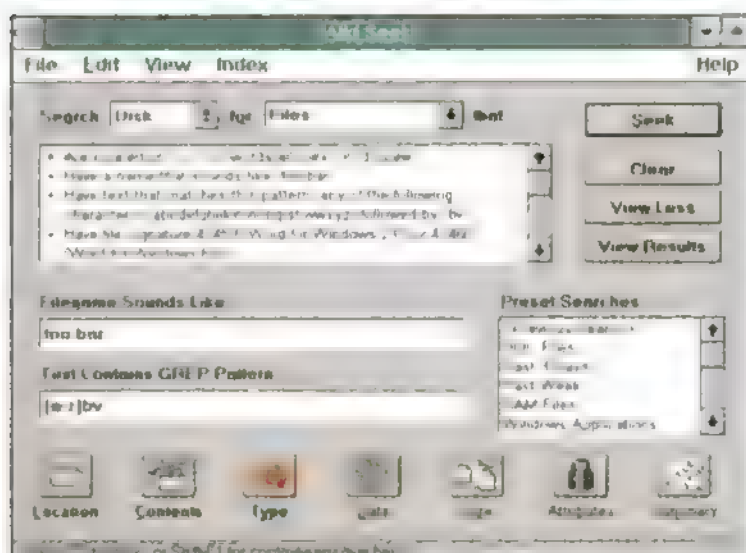
Alki Seek isn't very fast on unindexed text searches. Searching for a text string in 9MB of files took Alki Seek 175 seconds, while it took The Norton Desktop just 13 seconds and PC Tools 23 seconds.

If you have the PKUNZIP utility, Alki Seek can use it to search and index inside .ZIP files and to view files inside compressed archives. If Alki Seek finds text in a .ZIP file, it only tells you the .ZIP filename, not which file in the archive made the match.

Alki Seek has viewers for the major Windows word processors but doesn't show formatting. It not only lets you copy text from a file to the Clipboard but lets you append text to the Clipboard, too. It also serves as a drag-and-drop source or target.

• List price: *Alki Seek for Windows, Version 3.0*, \$69.95. Requires: 1MB RAM, Microsoft Windows 3.1. Alki Software Corp., 300 Queen Anne Ave. N., #410, Seattle, WA 98109; 800-669-9673, 206-286-2600; fax, 206-286-2785.

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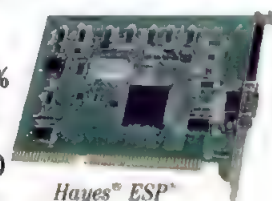
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Personal Finance

Microsoft Money 3.0 Adds Impressive On-Line Banking

BY CHRIS SHIPLEY

Microsoft used Version 1.0 of Microsoft Money to stake a claim in the explosive personal finance software market. It used Version 2.0, a well-tuned but limited upgrade, to let customers know it intended to stay, no matter how dominant Intuit's Quicken was. Now, in Version 3.0, Microsoft demonstrates that it will try to win not simply by virtue of its marketing prowess, but by delivering a well-designed, fully capable, competitive product.

The \$69.95 Money 3.0 (\$34.95 through April 15th) is the most capable version so far, including portfolio management and financial planning features for the first time. Microsoft has also added new on-line banking features that push personal finance software to new levels of convenience.

FIVE MINUTES TO START

Absolute ease of use is Money's primary goal. Even the most befuddled user needs no more than 5 minutes to begin entering basic transactions into the checkbook. The program takes you by the hand, making simple tasks obvious and easy to perform. Step off the well-trod track of checkbook and budget management, however, and Money leaves you more or less on your own.

That's not to say that you can't figure out how Money works from multiple account lists: a broad-based list for bank, cash, credit card, liability, and

asset accounts; a loan list that tracks amortization schedules and other loan-related specifics; and an investment list that deals with the peculiarities of these accounts. Getting all these account lists to work together is a bit of a trick, and Money doesn't provide much help. You'll also need to figure out how to link accounts and transfer entries from one account to another.

That complaint aside, the rest of the Money experience is a delight, from the cheeky sound effects of a cash register record-

schedules and quickly compares the terms of two loans. This calculator only hints at the help you will get from Money's Financial Wizards. These automated helpers evaluate mortgages, set savings goals, plan for retirement, and estimate interest costs and earnings. Throughout the process, the Wizards explain what data you need to enter, what it means, and how to act on the results.

These features are rounded out by investment-tracking capabilities, included in Money for the first time. Money's portfolio management capabilities are no better or worse than those you'd find in any other personal finance package, but they point to the most significant advancement in this version: the introduction of on-line connections.

PHONE FINANCE

You can pay bills on-line and get stock quote updates, just like you'll find both in Quicken and in MECA Software's Managing Your Money. Microsoft has tapped the National Payment Clearinghouse network to provide these extra-cost options, along with a third, more significant advancement in personal finance management: on-line banking.

Provided through three

regional banks—First National of Chicago, Michigan National Bank, and U.S. Bank—the "Bank On-Line" service lets Money users access up-to-the-minute statements of checking, savings, and credit-card accounts, transfer funds between accounts, and download transaction information to their Money register.

In Money's scheme for electronic financial services, each of the three banks sets the fees for Bank On-Line services, though the price should run about \$7.95 per month. The Pay On-Line bill payment service costs \$9.95 per month for the first 20 transactions and \$3.50 for each additional 10 transactions. Quotes On-Line costs \$3.95 per month for four calls to the service each month, with additional calls priced at 50 cents each.

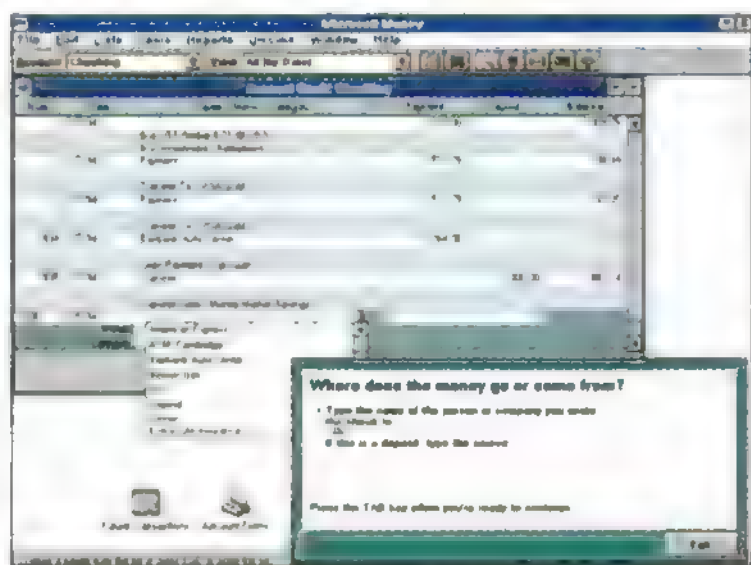
DARE TO COMPARE

With Microsoft and Intuit pushing both their software and the banking industry to incorporate these services in easy-to-use packages, you may wonder which package will best position you for the future. The answer for most people is either. Money imports data easily from Quicken's .QIF export format, though there's little reason for you to abandon Quicken in favor of Money unless you want to bank on-line with one of the three banks Money supports.

In most features—ease of use for basic functions, advanced features, electronic banking—Money and Quicken fight to a draw. Quicken makes it slightly easier to handle tougher financial chores, but Microsoft has come a long way to make Money 3.0 complete.

• List price: *Microsoft Money, Version 3.0*, \$34.95 until April 15, 1994; \$69.95 thereafter. Requires: 2MB RAM, 5MB hard disk space, Microsoft Windows 3.1. On-line services require a modem. Microsoft Corp., One Microsoft Way, Redmond, WA 98052-6399; 800-426-9400, 206-882-8080.

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CHECKBOOK: Help is always nearby.

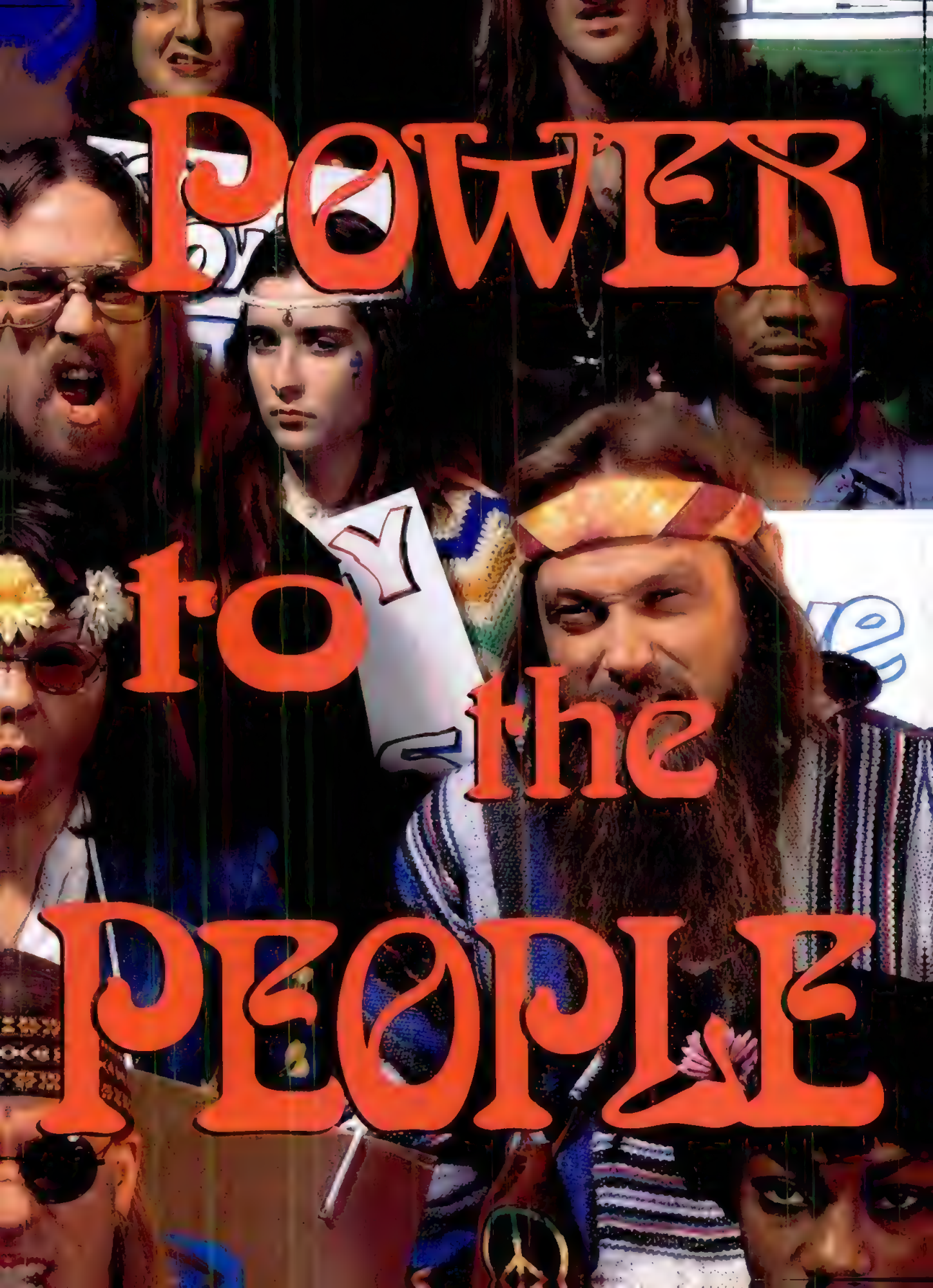
ing each transaction to the "scenic checks" background of the on-screen check and deposit forms. If you're the type who prefers a more dignified background, you can opt for that, too.

COOL CALCULATORS

Money turns ordinary financial calculators into outstanding planning tools. The program's loan calculator, for example, is the best implementation of a loan calculator in any personal finance package. It figures payments and amortization



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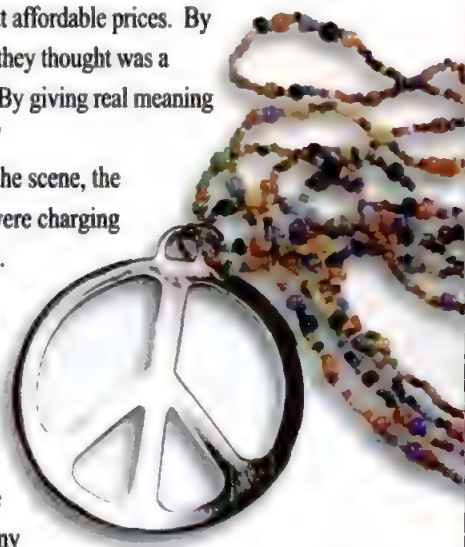


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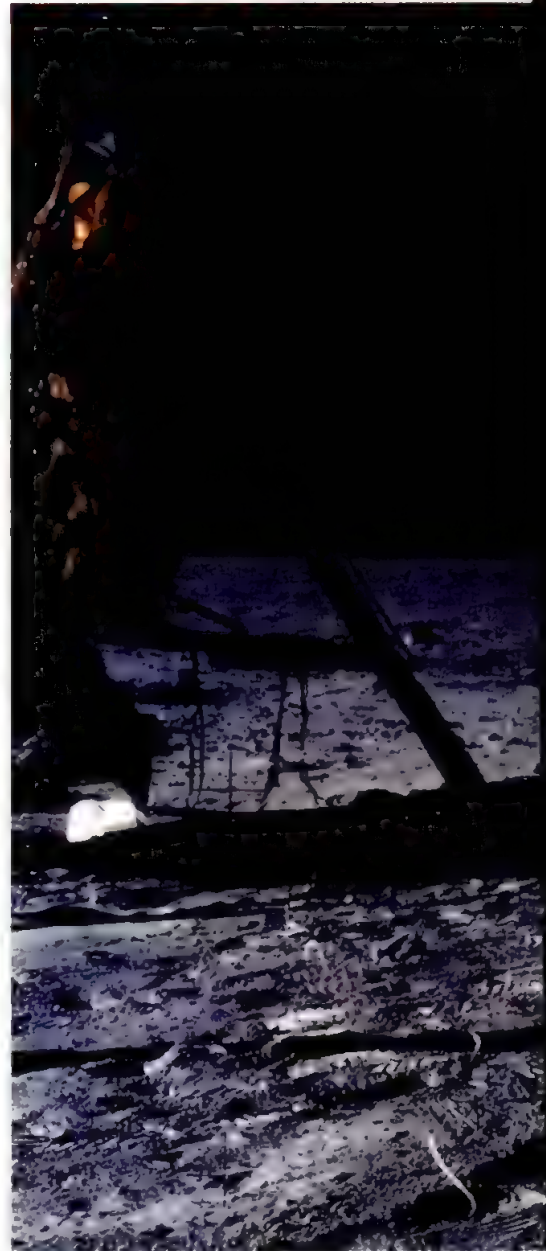


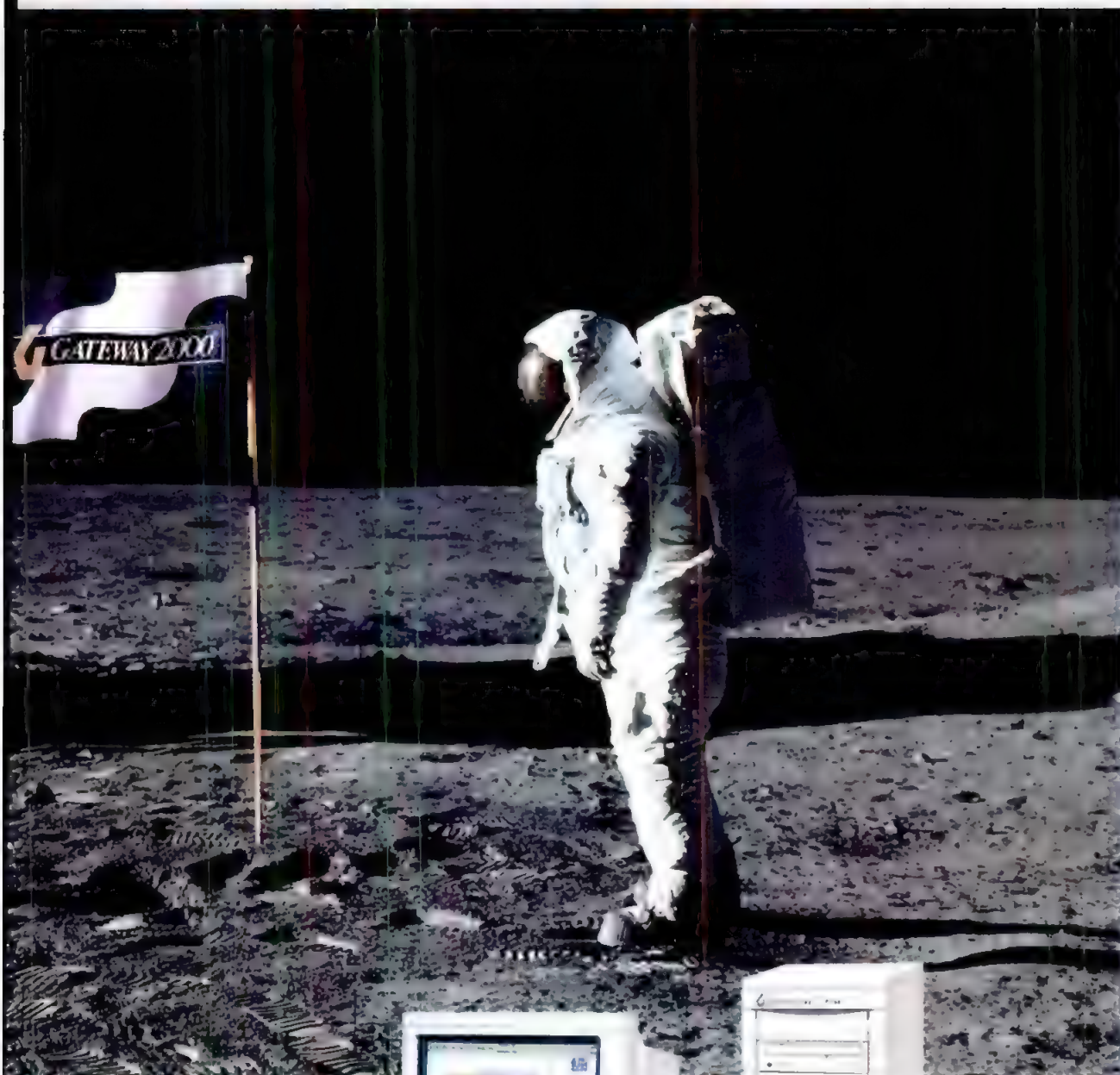
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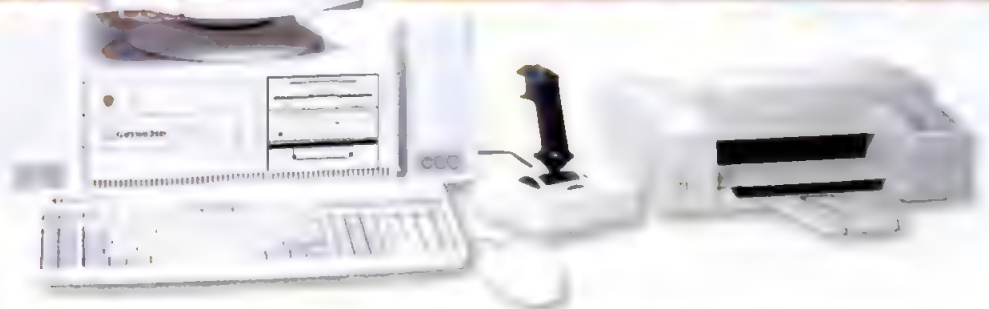
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Best Hand-Held/Palmtop



Add A Twist



Shown here is our P5-60 model loaded with options including a 17-inch CrystalScan monitor, combo floppy drive, multimedia kit with optional Yamaha speakers, Colorado Memory Systems tape backup unit, FlightStick and Epson Stylus 800 printer. With multimedia, the sights and sounds of any era are available to you with a click of your mouse. Right on!

PORTABLES

HANDBOOK™ 486

- Weight: 2.94 Lbs.
- Dimensions: 9.75" x 5.9" x 1.6"
- SL Enhanced Intel® 486 Processor
- 4MB RAM (expands to 8MB or 20MB)
- 80 to 130MB IDE Hard Drive
- 7.9" Backlit VGA Display
- NiMH Battery & AC Pack
- Suspend/Resume Feature
- 1 PCMCIA Type II Slot
- EZ Point™ Integrated Pointer
- 78-Key Keyboard
- Parallel, Serial & PS/2 Ports
- MS Works for Windows™
- MS-DOS 6.2, WFW 3.11 & Serial Transfer Cable

HANDBOOK 486SX-25

With 25MHz 486SX CPU and 80MB Hard Drive
\$1495

HANDBOOK 486DX2-40

With 40MHz 486DX2 CPU and 130MB Hard Drive
\$1995

HANDBOOK PACKS

Traveler's Packs:

- Case, extra battery & PCMCIA 9600/2400 fax/modem. **\$369**
- Case, extra battery & PCMCIA TelePath™ fax/modem. **\$489**

Presenter's Pack:

- PCMCIA VGA adapter, Asymetrix® Compel & case. **\$319**

PORTABLE OPTIONS

PCMCIA Cards:

- TelePath 14400/14400 fax/modem. **\$319**
- 9600/2400 fax/modem. **\$199**
- Ethernet adapter. **\$189**
- Token Ring adapter. **\$449**
- HandBook VGA adapter. **\$229**

Batteries:

- 2.2Ah NiMH batteries. **\$89**
- Alkaline battery pack. **\$29**

Diskette Drive:

- HandBook external 1.44MB. **\$99**

Cases:

- ColorBook **\$49** HandBook **\$55**

Extended VIP Warranty:

- We'll ship a replacement within 24 hours during warranty. Point of sale only. **\$100**

COLORBOOK™

- Weight: Under 5.7 Lbs.
- Dimensions: 11.7" x 8.5" x 1.77"
- SL Enhanced Intel 486 Processor
- 4MB or 8MB RAM (expands to 8, 12 or 20MB)
- 3.5" 1.44MB Diskette Drive
- Removable 120 to 250MB IDE Drive
- 9.4" VGA Dual-Scan STN Color Display
- NiMH Battery & AC Pack
- Suspend/Resume Feature
- 2 PCMCIA Type II Slots
- Integrated Trackball (2 buttons)
- 85-Key Keyboard
- Parallel, Serial & PS/2® Ports
- External VGA Port
- MS Works for Windows
- MS-DOS 6.2 & WFW 3.11

COLORBOOK 486SX-33

With 33MHz 486SX CPU, 4MB RAM and 120MB Hard Drive
\$1995

COLORBOOK 486DX-33

With 33MHz 486DX CPU, 4MB RAM and 250MB Hard Drive
\$2695

COLORBOOK 486DX2-50

With 50MHz 486DX2 CPU, 8MB RAM and 250MB Hard Drive
\$2995

COLORBOOK PACKS

Traveler's Packs:

- Case, extra battery & PCMCIA 9600/2400 fax/modem. **\$329**
- Case, extra battery & PCMCIA TelePath fax/modem. **\$449**

MULTIMEDIA KIT

Here's everything you need to add multimedia to any Gateway desktop PC. You won't find a better holiday price anywhere!

- Gateway 2000 16-Bit Sound Card, Sound Blaster™ Compatible
- Double-Speed CD-ROM
- 2 Labtec® Speakers
- Microsoft Encarta & Corel Photo CD Software
- Gateway System CD

\$299

For system configurations that include a CD-ROM drive: **\$132**
Only with system purchase.

SOFTWARE & EXTRAS

If a system comes with "choice of application software," choose one of the following packages:

- Microsoft Excel for Windows™
- Microsoft Word for Windows™
- Microsoft Word and Bookshelf® CD-ROM Edition
- Microsoft PowerPoint for Windows™
- Microsoft Project for Windows™
- The Entrepreneur Pack (Works,™ Publisher,™ Money™ & games)
- Borland Paradox® database and Quattro® Pro for Windows spreadsheet
- Microsoft Access™ for Windows
- Publisher's Pack (CD-ROM only; includes CorelDRAW3,™ ArtShow, MS Publisher 2.0 & MS Design Pack)

With desktop and selected portables you also get the following software and extras at no additional charge:

- MS-DOS 6.2 & Windows for Workgroups 3.11
 - CoSession™ Host Remote Diagnostics (with all modems)
 - QAPLUS Diagnostics
 - Gateway Computer Glossary
 - Gateway Mouse Pad
- Systems with CDs also include:
- Gateway System CD with Microsoft Multimedia Pack™
 - Multimedia On-Line User's Guide
 - Gateway Mall On-Line Catalog

SERVICE

Every Gateway system is backed by:

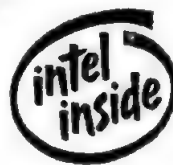
- 30-Day Money-Back Guarantee
- One-Year Limited Warranty
- Lifetime Toll-Free Technical Support
- On-Site Service Available To Most Locations
- Lifetime BBS Membership
- FaxBack Automated Fax Service

Our money-back guarantee does not include shipping. On-site service is provided at no charge during warranty if our technicians determine it is necessary. If you'd like to read our warranty and guarantee policies, please call for a free copy.



Printed on recycled paper with soy inks.

Gateway 2000 is a corporate sponsor of
GLOBAL REALITY



Networking

Intel EtherExpress™

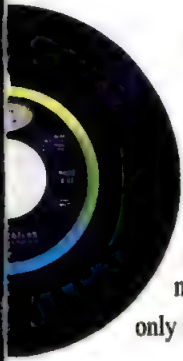
A 16-bit Ethernet adapter from a world leader in networking. **\$105** Twisted Pair or BNC Kit (BNC kit includes cable, connector, terminator and card).

Ethernet Adapter from 3Com®

Manufactured by 3Com for Gateway. Features parallel tasking architecture with a high level of integration. **\$105** Twisted Pair. **\$125** BNC Kit (includes cable, connector, terminator and card).

Monitors

CrystalScan® 17-Inch Monitor



Non-interlaced color monitor, .26mm dot pitch. If your system comes with a 14-inch monitor, you can upgrade to this monitor for **\$430**. If your system comes with a 15-inch monitor, you can upgrade for **\$350**. (Prices good only for upgrades at the time of system purchase.)

Printers

Epson® 1070+ Printer

Here's a value-priced, wide-carriage dot matrix printer that gives you 225cpi in draft mode, 10 letter-quality fonts and 4 scalable fonts. Quiet, too (46.5db)! **\$359**

Epson 3260 Color-Capable Printer

Add color to your documents with this 24-pin, quiet dot matrix printer. Comes with 10 letter-quality fonts. **\$199**; Color Option **\$45**; Tractor Option **\$15**

Epson Stylus 800 Ink Jet Printer

Great laser quality at an even greater value. Measuring only 17 inches by 10.5 inches, the Stylus 800 has seven different typefaces and prints an extra-quiet 150 characters per second at 360dpi. Parallel cable included. **\$289**

Epson ActionLaser 1500 Laser Printer

The ActionLaser delivers professional-quality printouts with crisp, sharp images, black blacks and smooth, "jag-free" lines. It also features a fast six-page per minute print speed, 14 resident fonts, 300 x 300dpi, and 1MB memory expandable to 5MB. Parallel cable included. **\$669**

TI microLaser™ Pro 600

This Texas Instruments laser printer redefines value in high-performance printing with 6MB RAM standard, a fast eight pages-per-minute print rate, 500-sheet capacity and true 600dpi quality.

With 23 PostScript® Fonts: **\$1,449**

With 65 PostScript Fonts: **\$1,629**



Lexmark 4039 10R

The printer for tomorrow's technology! Featuring a fast, RISC processor it switches between PostScript and PCL5 printer languages automatically and prints at a remarkable 10 pages per minute at true 600dpi. **\$1,399**

Easy Payment Options

We make it easy for you to buy a Gateway PC, too! We accept most major credits cards and C.O.D. terms, with net 30-day terms and leasing options available to qualified commercial customers.



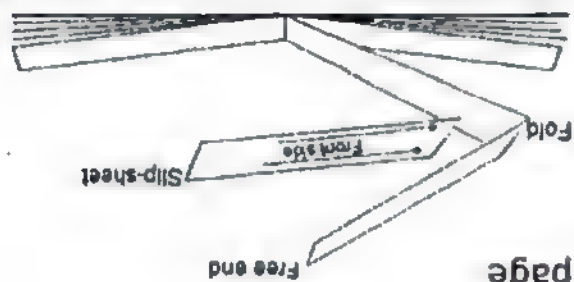
You can also apply for our new Gateway 2000™ DuoLine™ MasterCard® Card, issued by Dial National Bank, which lets you make purchases from Gateway and anywhere else MasterCard is accepted by giving you two lines of credit — one for Gateway purchases and one for all other purchases. For Gateway purchases, the card has no annual fee and a low variable interest rate of just 12.9% APR. For other transactions, you get a variable interest rate of 13.9% APR and a low \$18 annual fee.*

*Cash advance fee is \$1 plus 2% of the amount of the cash advance, but not less than \$5 nor more than \$10. Financing is available on approved credit with the Gateway DuoLine MasterCard, issued by Dial National Bank, Des Moines, Iowa.



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Our '60s models are all Gateway 2000 employees and their children who relived the flower-power era for this ad.



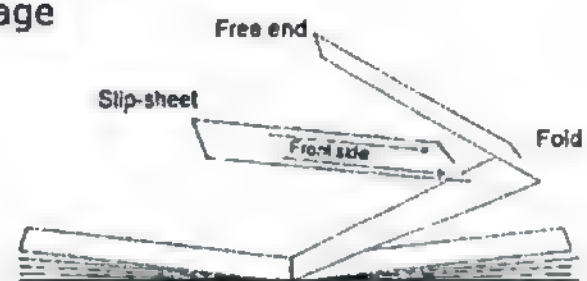
1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

Inverted Foldout slip-sheet



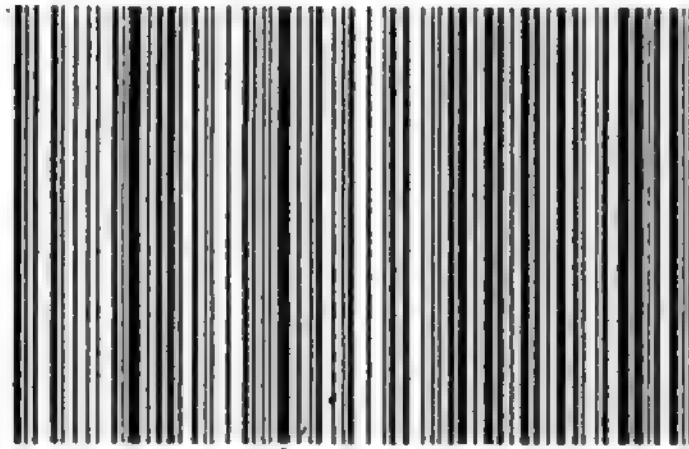
Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



GbsSlpBack-0018

Back

1. Follow instructions on the other side

To Your Gateway PC!



When you've picked the PC you want, take a look at the options listed here to make your system as productive and fun as possible. Sorry, the peripherals listed here are sold only with the purchase of a system. For details on our complete line of extras for Gateway customers, ask for our special add-on components division when you call.

Multimedia

Multimedia Kit

Here's everything you need to add multimedia to your Gateway PC:

- Gateway 2000™ 16-bit CD-quality sound card, compatible with Sound Blaster™ cards, with MIDI/game port, mic in, stereo line in/out
 - Double-speed CD-ROM drive, tray-loading, compatible with music CDs, multisession photo CDs and CD-ROM titles
 - 2 Labtec® speakers that attach to your PC monitor
 - Microsoft® Encarta & Corel Photo CD software
 - Gateway 2000 System CD with Microsoft Multimedia Pack™
- \$299**

For system configurations that include a CD-ROM drive, get the multimedia kit without CD-ROM drive for: **\$132**

Yamaha®YST-M10 Multimedia Speakers

New! The small speakers that sound big. And come with a tiny price. This free-standing, self-powered speaker set is a great value! **\$75**

Altec Lansing Multimedia Speakers

Get superior stereo sound with these top-rated Altec Lansing ACS-300 speakers with separate powered subwoofer. **\$219**

CH FlightStick

The joystick that's recommended by our kids! With a sensational "feel" and rugged construction, this is the last joystick you'll ever have to buy! **\$35**

Communications & Storage

TelePath™ II Fax/Modem

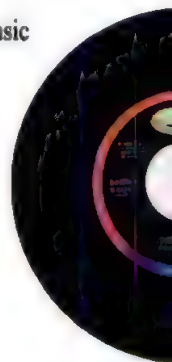
Internal fax/modem, 14,400bps modem, V.32bis, with 14,400bps fax capability. Package includes CommWorks™ data and fax communication software, plus a CompuServe® trial membership. **\$149**

Cardinal® 2400 Fax/Modem

Internal fax/modem, 2,400bps modem, V.22bis, with 9,600bps fax capability. Package includes CommWorks data and fax communication software. **\$49**

Colorado Memory Systems® TBU

250MB internal automatic tape backup unit copies up to 9.5MB per minute. Comes with Windows and DOS software, one tape and cable. **\$159**



INTEGRATED & VESA SYSTEMS

4SX-33/4DX-33

- Intel® 33MHz 486SX or DX CPU
- 4MB RAM
- 212MB 13ms IDE Hard Drive
- Local Bus Graphics with 512KB
- 3.5" Diskette Drive
- 14" Color CrystalScan® 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 101-Key Keyboard & MS Mouse
- MS-DOS® 6.2 & WFW™ 3.11
- MS Works for Windows™
- EPA Energy Star Compliant

4SX-33 - \$1295

4DX-33 - \$1495

4DX2-50/4DX2-66

- Intel 50 or 66MHz 486DX2 CPU
- 8MB RAM, 128KB Cache
- 212MB 13ms IDE Hard Drive
- Local Bus Graphics with 1MB
- 3.5" Diskette Drive
- 14" Color CrystalScan 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- AnyKey® Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software
- EPA Energy Star Compliant

4DX2-50 - \$1795

4DX2-66 - \$1995

4SX-33V

- Intel 33MHz 486SX CPU
- 4MB RAM
- 212MB 13ms IDE Hard Drive
- VLB™ Graphics with 1MB
- Local Bus IDE Interface
- 5.25" & 3.5" Combo Drive
- 14" Color CrystalScan® 1024NI
- Baby AT Case
- 5 ISA & 2 VESA®/ISA Slots
- AnyKey® Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software
- EPA Energy Star Compliant

\$1495

4DX2-50 FAMILY PC™

- Intel 50MHz 486DX2 CPU
- 8MB RAM, 128KB Cache
- 212MB 13ms IDE Hard Drive
- Local Bus Graphics with 1MB
- Double-Speed CD-ROM, 16-Bit Sound Card & Speakers
- 2400/9600 Data/Fax Modem
- 3.5" Diskette Drive
- 14" Color CrystalScan 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 101-Key Keyboard, MS Mouse & Joystick
- Choice of Family PC Software
- EPA Energy Star Compliant

\$1995

VESA & PCI SYSTEMS

4DX-33V/4DX2-50V

- Intel 33MHz 486DX or 50MHz DX2 CPU
- 8MB RAM, 128KB Cache
- 424MB 13ms IDE Hard Drive
- VLB Graphics with 1MB
- Local Bus IDE Interface
- 5.25" & 3.5" Combo Drive
- 14" Color CrystalScan 1024NI
- Baby AT Case
- 5 ISA & 2 VESA/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software
- EPA Energy Star Compliant

4DX-33V - \$1975

4DX2-50V - \$1995

4DX2-66V BEST BUY

- Intel 66MHz 486DX2 CPU
- 8MB RAM, 128KB Cache
- 424MB 13ms IDE Hard Drive
- VLB Graphics with 1MB
- Double-Speed CD-ROM
- Local Bus IDE Interface
- 3.5" Diskette Drive
- 15" Color CrystalScan 1572FS
- Baby AT Case
- 5 ISA & 2 VESA/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software
- EPA Energy Star Compliant

\$2295

P4D-66

- Intel 66MHz 486DX2 CPU
- 8MB RAM, 256KB Cache
- 424MB 13ms IDE Hard Drive
- PCI Local Bus Graphics with 2MB
- Double-Speed CD-ROM
- PCI Fast IDE Interface
- 3.5" Diskette Drive
- 15" Color CrystalScan 1572FS
- Baby AT Case
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software

\$2495

4DX2-66V

- Intel 66MHz 486DX2 CPU
- 16MB RAM, 256KB Cache
- 424MB 13ms IDE Hard Drive
- VLB Graphics with 2MB
- Double-Speed CD-ROM
- Local Bus IDE Interface
- 3.5" Diskette Drive
- 15" Color CrystalScan 1572FS
- Baby AT Case
- 5 ISA & 2 VESA/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software
- EPA Energy Star Compliant

\$2795

PENTIUM SYSTEMS

P5-60

- Intel 60MHz Pentium™ CPU
- 8MB RAM, 256KB Cache
- 424MB 13ms IDE Hard Drive
- PCI Local Bus Graphics with 2MB
- PCI Fast IDE Interface
- 3.5" Diskette Drive
- 14" Color CrystalScan 1024NI
- Baby AT Case
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- MS Works for Windows

\$2495

P5-60 BEST BUY

- Intel 60MHz Pentium CPU
- 8MB RAM, 256KB Cache
- 424MB 13ms IDE Hard Drive
- PCI Local Bus Graphics with 2MB
- Double-Speed CD-ROM
- PCI Fast IDE Interface
- 3.5" Diskette Drive
- 15" Color CrystalScan 1572FS
- Baby AT Case
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software

\$2795

P5-60

- Intel 60MHz Pentium CPU
- 16MB RAM, 256KB Cache
- 540MB 13ms IDE Hard Drive
- PCI Local Bus Graphics with 2MB
- Double-Speed CD-ROM
- PCI Fast IDE Interface
- 3.5" Diskette Drive
- 15" Color CrystalScan 1572FS
- Baby AT Case
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software

\$3295

P5-66

- Intel 66MHz Pentium CPU
- 16MB RAM, 256KB Cache
- 540MB 13ms IDE Hard Drive
- PCI Local Bus Graphics with 2MB
- Double-Speed CD-ROM
- PCI Fast IDE Interface
- 16-Bit Sound Card & Speakers
- 3.5" Diskette Drive
- 17" Color CrystalScan 1776LE
- Tower Case, 300W Power Supply
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software

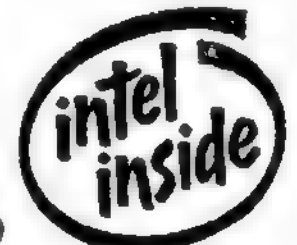
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■ Sound

Sound Assist: A "Tape Recorder" for Voice Notes

BY KEVIN BACHUS

Most business executives who have been enticed by the dream of voice annotation have found that the reality falls far short. Visions of point-and-click memo dictation quickly fade under an onslaught of installation nightmares, convoluted software schemes, and incompatible file formats.

PCVoice has changed the rules with its new \$249 voice-annotation device, PCVoice Assist. A sound recorder/speaker that combines an ingenious design resembling a hand-held cassette recorder with a set of intuitive, truly useful utilities, Assist makes voice annotation easy.

Assist succeeds where so many other audio products have stumbled primarily because of its unique design. What sets it apart is a full complement of standard audio tape controls located on the unit's side. The purpose of the buttons—which are clearly marked Rec, Play, Pause, Stop, Rew, and FF—is obvious.

Pressing a button launches a Microsoft Windows application called PCmemo. At first glance, PCmemo looks a bit like the Sound Recorder applet that ships with Windows 3.1, but its superb integration with the Assist hardware makes it far more useful.

Want to add a recorded memo to a spreadsheet? Simply press Assist's Record button and start talking. No more complicated pull-down-menu schemes to remember. Want to transcribe previously recorded notes into a word processing document? Use the Play, Fast-Forward, and Rewind buttons just as you would on a microcassette recorder and type away.

Assist also includes two other

clever utilities. The Thoughts utility lets you define subject groups—different projects that you're working on, for example—and record and save ideas related to that subject for later review. The program's Action Items group lets you save and review reminders at a glance.

Assist's Guided Tour gives power users the tools they need to create an interactive demo of a Windows application complete with voice notes. Guided



SPEAK UP: Assist acts like a cassette recorder.

Tour records mouse and keyboard activity, as well as synchronized voice narration for

playback on any system that is equipped with a sound card.

Assist's slim design and serial interface make it particularly well suited to the demands of portable PC users. And because the unit runs on a rechargeable 9-volt battery, Assist doesn't affect the notebook's battery life.

Assist is a refreshing change in multimedia. Straightforward and practical, it makes voice annotation possible without making you face unnecessary and confusing bells and whistles.

• List price: PCVoice Assist, \$249. PCVoice Inc., 11205 Alpharetta Hwy., Suite C-4, Roswell, GA 30076; 404-343-8201; fax, 404-442-3156.

Circle 411 on reader service card

■ SCSI

DPT's SmartCache Cards Smooth the Way for SCSI

BY JAMES KARNEY

Distributed Processing Technology's new SmartCache III host adapters offer serious SCSI shoppers a smorgasbord of options that can be customized to fit almost any need, from basic workstations to high-end servers. Starting at \$285, the cards can be expanded to provide hardware RAID capability and up to 64MB of error-correcting cache. To top it off, DPT bundles some very slick setup and management tools.

The three SmartCache adapters use a modular approach. All are equipped with a Motorola coprocessor to reduce system overhead and control both SCSI functions and options, which are added via daughtercards. The ISA-based PM2021 (\$285) and EISA-based PM2022 (\$449) are configured with a 16-MHz Motorola 68000 chip, while the EISA-bus PM2122 (\$595) comes with a 20-MHz 68020. DPT plans to expand the line later this year with multi-SCSI channel and PCI versions. A small daughtercard is used to add RAID to a SmartCache III card.

The DM4000 (\$555) lets you create and manage hardware RAID levels 0, 1, and 5.

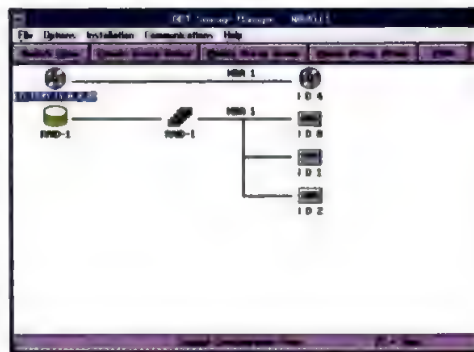
You set up the adapters and modules with the bundled Storage Manager software. It lets you configure options and check the operation of devices on the SCSI bus, and you can even use it to examine system usage in real time, either locally or across a network.

To see how well the cards worked, we installed both Windows for Workgroups and NetWare 3.12 on a 66-MHz 486-based system with 16MB RAM, three 1GB IBM 662 Fast SCSI-2 hard disks, and an external Texel CD-ROM drive. We used the PM2122 EISA card with 16MB of ECC RAM and the RAID module installed.

On PC Labs' tests, the system produced a Winstone 94 score of 42.2 and a Winbench 4.0 Disk WinMark of 992 kilobytes per

second. We then loaded several files using the test system both standalone and as a file server. File load times on the test server and on the workstation (which had 16MB RAM, an Ultrastor U34F VL-bus adapter, and a matching Fast SCSI-2 hard disk) were just about identical.

The SmartCache III SCSI adapters may cost a bit more than bargain cards, but their



STORAGE MANAGER: The included software monitors your SCSI setup.

design, utilities, and expandability make them a serious solution for power users and network administrators.

• List price: SmartCache III PM2021, \$285; PM2022, \$449; PM2122, \$595; cache and RAID modules, \$555 each. Distributed Processing Technology, 140 Candace Dr., Maitland, FL 32571; 407-830-5522; fax, 407-260-5366.

Circle 422 on reader service card

Printers

Canon BJ-200e: Subtle Improvements for An Optimal Ink Jet

BY SCOT FINNIE

When you already make one of the world's best ink jet printers, upgrading it is more a matter of refinement than radical overhaul. And that's just what Canon has done with its new BJ-200e, which replaces the BJ-200 while holding the line at \$399.

Canon has improved on the BJ-200's graphics print quality by eliminating its tendency toward banding and improving the dither pattern. The result is better gray-scaling with lighter, more even grays. This improvement stems from Canon's redesign of the BJ-200's paper-handling mechanism. The printer now feeds the paper both more evenly and more quickly, making it less likely to jam.

The BJ-200e is a better Windows printer, too. It comes with 20 TrueType soft fonts, and the printer driver installs more easily by optionally bypassing Windows' Control Panel in favor of a fast File Run command-line installation. The BJ-200e also prints text bidirectionally under Windows.

The BJ-200 was already among the fastest desktop ink jet printers on the market, so performance gains are slight. Tests showed that straight-text DOS and Windows documents printed at about the same rate as the BJ-200, but we clocked an 11 percent speed boost on complex text and graphics. Rated print speeds on the BJ-200e are the same as for the BJ-200: 248 characters per second in high-speed mode and 173 cps in high-quality mode.

Like the BJ-200, the BJ-200e has 360- by 360-dot-per-inch resolution. It uses a 64-nozzle print head, has a 100-sheet paper tray, and comes with Canon BJ-10e,

IBM Proprinter X24E, and Epson LQ 510 emulations. It uses the same ink cartridge as the BJ-200 and has the same 6.6-pound weight and diminutive case dimensions.

What could still use improvement? Not much. Text printing could be darker, and Epson's Stylus 300 beats the BJ-200e for



REFINED: The BJ-200e provides better graphics.

text blackness. The BJ-200e's characters are slightly better formed than Stylus', though, and while the Stylus lists for \$50 less, the BJ-200e is faster.

Hewlett-Packard's \$379 DeskJet 310 prints a bit faster than the BJ-200e and can optionally print in color, but you need to feed paper manually one sheet at a time.

With a street price under \$300, the BJ-200e takes over where the BJ-200 left off: as the best value and all-around top choice among desktop ink jet printers.

• List price: Canon BJ-200e, \$399. Canon Computer Systems Inc. 2995 Redhill Ave. Costa Mesa, CA 92626; 800-848-4123, 714-438-3000; fax, 714-438-3317.

Circle 433 on reader service card

Businessware

Destiny Builds Business Plans Without Pain

BY ELLEN DEPASQUALE

Planet Corp.'s Destiny breaks the mold of the complex business-plan software package. The first business-plan program to include a built-in spreadsheet and word processor, it's easy to use and makes the entire process of designing a business plan simple to understand.

The \$249.95 program (\$129.95 until April 1) was developed in conjunction with certified public accountants, so it produces a business-plan structure that accountants will be familiar with. The on-line help will get you through the fundamentals of your plan, and a complete sample business plan is included in the manual.

Business plans consist of both financial and managerial information. That's why Destiny includes the spreadsheet and word processor. It's unnecessary to interact with any other package to get the job done. The built-in utilities don't have the power of Microsoft Excel or Word for Windows, but they do adjust column and row size, cut and paste text, and insert and delete anywhere.

Destiny's real power is in its

spreadsheet templates. They present only the columns or rows you need for each report. For example, the sales plan allows data from January to December and summary data for each quarter, so all you see is 16 columns. Once you have entered data in a specific sheet, it carries a check mark on the pull-down menu, noting that the work is in progress. Reports generate from templates that hold all the necessary calculations.

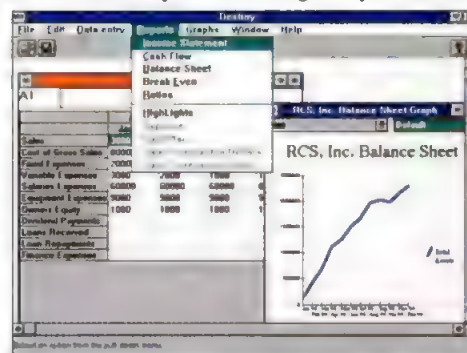
The sample business plan covers just about everything you'd want to know about a business, but Destiny doesn't force you to put every possible report into your plan. A dialog box lets you choose which sections you want to include.

Graphs to enhance the business plan and help readers understand it are available for the most important sections: Income Statement, Cash Flow, Balance Sheet, and Break Even.

As one of the only business-

plan programs for Windows, Destiny makes it easy to cut and paste into and out of other Windows apps. You can also import and export to DOS-based apps.

Destiny is both simple and powerful. It gives you all the



SMART START: Destiny guides you through all aspects of a business plan.

tools you need to build your business plan but takes out all the headaches.

• List Price: Destiny, \$249.95; \$129.95 until April 1, 1994. Requires: 2MB RAM, 10MB hard disk space, Windows 3.0 or later. Planet Corp., 100 Pleasant St., Worcester, MA 01609; 800-366-5111, 508-757-6555; fax, 508-757-2426.

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perfect database for organizations that use both operating systems. You can even copy DOS data and application files to UNIX without modification.

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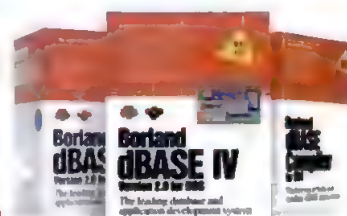
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1 Usability Science Corporation, dBASE IV v2.0 vs. FoxPro v2.5, June 1993. 2 dBASE IV for UNIX sold separately. 3 dBASE Compiler for DOS sold separately. 4 See special offer in dBASE Compiler box or call Intel at 1-800-538-3373, ext. 249 for a free demo diskette. Prices good in the United States and Canada only. All prices are in U.S. dollars. Dealer prices may vary. Copyright © 1993 Borland International, Inc. All rights reserved. All product names are trademarks of their respective companies. BI 6429.1

■ Communications

BitFax 3.0: Voice, Data, And Fax in One Interface

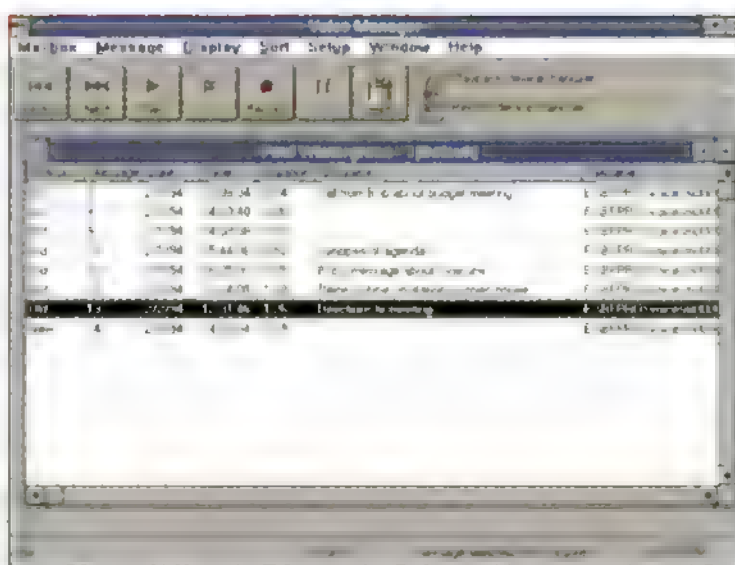
BY DAVID HASKIN

BitFax Professional, Version 3.0, is an intriguing Windows communications product because it points toward the day when our computers will seamlessly handle messages from all sources. However, this initial attempt at harnessing the capabilities of new voice/fax/data modems still needs polish.

Bit Software's \$129.95 program ties together separate voice-mail, fax, and data comm programs in its Receive Man-

ager utility. Besides preventing port contention, Receive Manager determines the type of the incoming call, routes the call to the appropriate program, and notifies you after it receives the message or data file.

Receive Manager works without having to load the three separate programs first, and it requires only about 250K of RAM. Leaving it loaded turns your standalone PC into an automated multipurpose com-



ANSWERING SERVICE: Voice Manager lists all calls you've received and enables you to play them back.

Voice Manager displays received calls in user-created mailbox logs. If you get many calls, you'll need plenty of disk space. While voice modems compress messages before sending them to disk, the messages still require about 100K per minute.

Since there is no network version of BitFax and it has no hooks into PBX systems, Voice Manager is appropriate only for single users and for situations such as after-

hours switchboards. It also lacks the ability to stop voice-mail when you pick up the receiver.

The fax module's impressive list of high-end features includes automatic fax forwarding, remote polling for received faxes, optical character recognition, and the ability to annotate faxes.

The old BitCom data communications package won't win awards for power or innovation: It doesn't even have a learn mode for its script language. While BitCom and BitFax's fax capabilities are well refined, Bit Software's efforts to combine these older programs with the newer Voice Manager and Receive Manager results in some rough edges. One example: Modems listed in the communications setup dialog box are not in alphabetical order. This is just a tiny gripe, but there are enough of them to make BitFax Professional just a little bit clunky.

Voice modems are new, so Bit Software's uneven first attempt at supporting them is forgivable. Updates should make Receive Manager more robust, add more voice features, and smooth the rough edges.

• List price: *BitFax Professional, Version 3.0*, \$129.95. Requires: 4MB RAM; 8MB hard disk space; Microsoft Windows 3.1; Class 1, Class 2, or CAS fax modem. Bit Software Inc., 47987 Fremont Blvd. Fremont, CA 94538; 510-490-2928; fax, 510-490-9490.

Circle 432 on reader service card

■ Database Access

d.b.Express: The Bar Chart Approach to Databases

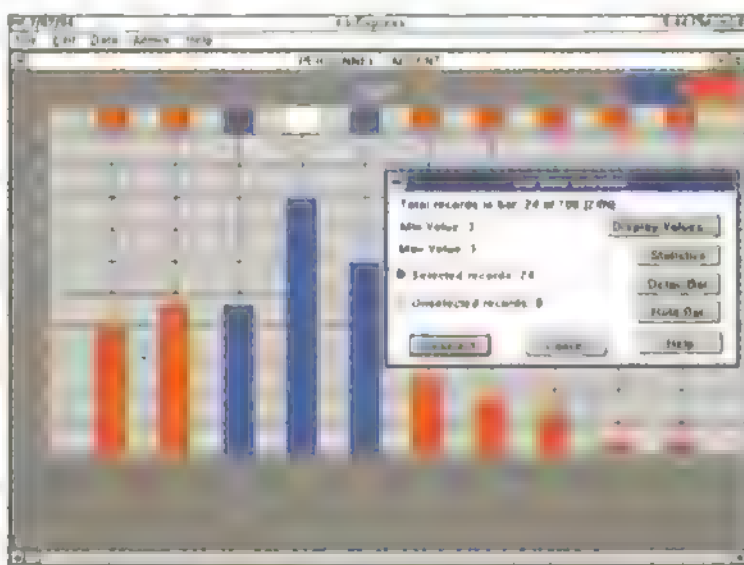
BY RON ANDERSON

Now that the information age is upon us, software developers are scrambling to equip nontechnical professionals with data analysis tools.

Computer Concepts Corp.'s contribution to this genre, d.b.Express, Version 1.0, takes a visual, interactive approach to data analysis that tries to maximize ease of use but sacrifices power and flexibility in the attempt. The program sticks to a single method of viewing data: interactive bar charts that are called distribution charts.

Even though the slim documentation for the \$595 program stresses ease of use, you'll need some knowledge about databases, tables, and joins to build these charts. It is clear that Computer Concepts assumes expert database administrators will build the charts for nontechnical users to analyze.

To create a distribution, you select a database, tables, and fields, and create joins between tables where necessary. This process flows pretty smoothly from step to step and is largely a point-and-click operation. Once distributions are created, you



BAR CHARTS: You do your analysis on a visual distribution of the data.

select them from the Data menu for charting.

To analyze distribution chart data, you start with a distribution of the entire data set, selecting data of interest with the mouse, highlighting it, and re-charting it against other vari-

ables to visualize their relationships. The lack of an undo or backup feature puts a crimp in your ability to explore relationships at will; a misstep requires that you start over again.

d.b.Express can import and analyze data from ASCII and Paradox files, xBASE formats, and through ODBC (Microsoft's Open Database Connectivity) connections to SQL relational database-management systems. You can export selected data to ASCII, Paradox, and xBASE files.

Computer Concepts has attempted to carve a niche for itself in a very competitive market by providing a visual, interactive tool for decision support. This first effort is a unique approach that has some merit but needs refinement and additional functionality before it can become a major contender.

• List Price: *d.b.Express, Version 1.0*, \$595. Requires: 4MB RAM, 2MB hard disk space, Microsoft Windows 3.1. Computer Concepts Corp., 80 Orville Dr., Bohemia, NY 11716; 800-619-0757, 516-244-7700; fax, 516-563-8085.

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The pizza box-size Mainstream Data receiver connects to your PC via a serial cable. You see a window of headlines and the wire services they're coming from. You can set up your own keyword criteria for individual subject categories, and each subject gets its own window of headlines.

As far as Windows programs go, this one doesn't have much going for it. Most operations can be performed only by mouse, which we found to be a disadvantage: Sometimes it's more convenient to use the keyboard. When you make changes in the program configuration, you have to force a save or risk losing the changes should your system hang.

You can sort incoming stories by headline, news service, or date and time, which is sufficient for most purposes. The Quick Search facility finds any word or phrase, but it's hardly quick. After you launch a search, you get a blank window and a seemingly live cursor that does nothing. This looks to all the world like a program crash, but Quick Search returns with the retrieved

Mainstream Newscast is expensive. The satellite version costs \$2,490, and the FM version is \$500 less (both include installation and setup). That doesn't include subscriptions to the individual

wire services, which can range from \$10 per month for USA Today through \$500 per month for DowVision.

After all this carping, you



might think we didn't like Newscast. Yes, it's flawed and pricey, but it's also utterly addicting. If you need news in order to make better decisions, to keep an eye

on the competition, or to keep your employees or coworkers informed, Newscast is invaluable.

The price is coming down, too. A new version is due this fall that will deliver the news you want in just as timely a fashion—for a much lower price.

- **List price:** *Mainstream Newscast for Windows*, \$2,490 (satellite version); \$1,990 (FM version). Requires: 2MB RAM, serial port, Microsoft Windows

**3.1. Mainstream Data Inc., 420
Chipeta Way, #200, Research
Park, Salt Lake City, UT 84108;
801-584-2800; fax, 801-584-2831.
Circle 429 on reader service card**

Tapedisk Makes Your Tape Drive Think It's a Hard Disk

Although tape is by far the cheapest data storage media—as low as a half-cent per megabyte—its inherent slowness and the necessity to access the data through backup software has restricted tape to archival use only. A novel utility called Tapedisk (\$250) allows many popular QIC and DAT tape drives to operate as if they were hard disks, which means that you can view, load, edit, and save files on tape from within any Windows or DOS application. The obvious advantage is direct and immediate access (albeit at a snail's pace) to gigabytes of data. But it does come at a price: Tapedisk is tedious to get up and running, and failing to unload properly the program will render a tape unreadable.

It takes three steps to make Tapedisk work. First, you run **TAPEDISK.EXE**, either from the DOS prompt or by manually adding a **DEVICE** statement to the **CONFIG.SYS** file. Next, you have to make sure that your tape is formatted with Tapedisk's **TDFORMAT** command.

Then you type in the mounting command (TDLOAD:drive).

If all this sounds a little convoluted, it is. But once you have the program running, the tape formatted, and the drive mounted (a sequence that can be initiated automatically by creating a macro), the rest is almost as easy as accessing a hard disk. For instance, we had no difficulty loading 29MB image files directly into Adobe Photoshop from DAT tapes or making full backups from the DOS prompt using a copy command. Note, though, that Tapedisk works best with its own commands. It is possible to use regular DOS commands, but we locked up the drive several

times by using the COPY *.* command instead of Tapedisk's TDXCOPY *.*.

Tapedisk's greatest drawback is that if you don't use the TDUNLOAD command before changing tapes or turning off the computer, you will lose all the data on that tape, and there is no way to recover it.

If you regularly work with large DTP, multimedia, and digital imaging files that are stored on tape for economy's sake, Tape-disk is an indispensable program. But if you use a tape drive primarily as data insurance, you'll probably be much happier with a conventional backup program.

• **List price:** *Tapedisk*, \$250. **Requires:** 4MB RAM, DOS 5.0 or later. *Tapedisk Corp.*, 2908 Fond du Lac Rd., Oshkosh, WI 54901; 800-827-3372, 715-235-3388; fax, 715-235-3818.

Circle 421 on reader service card

Remember that tape drives aren't fast. It takes about 20 seconds to read the directory of a 60MB DAT tape (the time varies with the particular drive or model), and the average data-transfer time on a Wangtek 2600 drive is a relatively modest 11 megabytes per minute. Since DOS and Windows are single-threaded operating systems, some Tapedisk commands will seize control of your computer for a minute or two and appear to lock up the system. Whatever you do, don't reboot the computer!—*DG*



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■ Presentation Graphics

Astound: Multimedia Shows For Beginners and Pros

BY J. W. OLSEN

For some time, the product of choice for creating presentations that blend sound, graphics, and animation has been MacroMedia's Action!, but now Gold Disk has a viable alternative for about \$100 less. Priced at \$399 (\$129 through April 30, 1994), Astound for Windows, Version 1.5, has just about the same features as Action! and tosses into the bargain a degree of Macintosh-PC portability and a CD-ROM packed with 1,200 multimedia clips—sound effects, music, animation, and graphics. The CD-ROM also holds a run-time version of Microsoft Video for Windows.

The first thing that strikes you about Astound is that despite its extensive set of features, even a neophyte can generate a simple presentation quickly. You select from 50 diverse templates, click on text objects to enter your own text, click on graphics objects to add your own graphics (or you can use selections from the CD-ROM), and you can have your first presentation within an hour, complete with animation and sound effects. Astound holds the hand of beginners, growing gracefully with them as needs arise. At the same time, presentation pros will find nearly as much here to please them as in any competitor.

Astound for Windows follows Gold Disk's popular Astound for Macintosh. If your organization embraces both platforms, you'll be happy to know that Astound will accommodate you. You can now import Astound for Macintosh 1.0 presentations into Astound for Windows 1.5 for additional refinement or to create standalone

executables that run on other Windows systems, with or without Astound present. Astound for Windows also exports presentations into a format that Gold Disk says the forthcoming Astound for Macintosh 1.5 will be able to exploit.

EASY IN, EASY OUT

If you have a collection of Microsoft PowerPoint or Freelance Graphics presentations, Astound for Windows can import them in editable form. And if you need traditional slides or overhead transparencies, Astound helps by generating requisite files for production by service bureaus. Astound makes it especially easy to use AutoGraphix service bureaus through a module that sends your files to them via modem. The program also generates speakers' notes and handouts.

If you've used presentation packages like Harvard Graphics for Windows, you will immediately feel comfortable with Astound, which uses both slide-show and collapsible-outline metaphors. You can work in either mode or easily jump between them.

The slide-sorter mode behaves like an on-screen light table to view all of a presentation's slides simultaneously. To rearrange slides or copy them to other presentations, you drag and drop. A similar process within a timeline window

makes it easy to change transition durations, add pauses, and synchronize events, all within a single window.

Text editing is a breeze with rulers, tabs, four-level bullet formatting, and a built-in spell-checker just a click away. There is sound support for MIDI, .WAV, and CD audio files, or you can record and edit your own sound files.

ANIMATION FESTIVAL

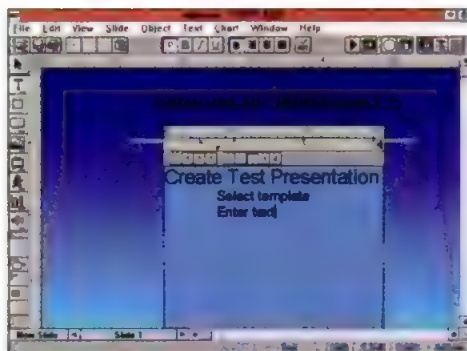
Graphics up to 24-bit color in about a dozen file formats, including Photo CD, merge easily into presentations, and the program has three digital video formats: DVI, QuickTime for Windows, and Video for Windows. There are dozens of styles of built-in charts and graphs, and you can animate them with over 30 transitional effects so they appear to assemble before viewers' eyes. There's a pop-up palette of 20 drawing tools to create your own graphics, and you can animate any object simply by defining a path with your mouse.

Astound does not attempt to match the capabilities of high-end authoring tools like Authorware Professional for Windows or IconAuthor, but it does have limited end-user interactivity through buttons you can assign to any object within a presentation. You use them to enforce a pause, play sounds, jump to another slide, or restart the entire presentation, all without scripting.

Astound for Windows is one of those rare delights that meets the needs of pros while being easy for beginners right out of the box. Regardless of your multimedia presentation needs, Astound deserves careful consideration—especially in light of its competitive pricing.

- List price: *Astound for Windows, Version 1.5*, \$399. Requires: 4MB RAM, 6MB hard disk space (18MB for full installation), Microsoft Windows 3.1. Gold Disk Inc., 3350 Scott Blvd., Bldg. 14, Santa Clara, CA 95054; 800-982-9888, 408-982-0200; fax, 408-982-0298.

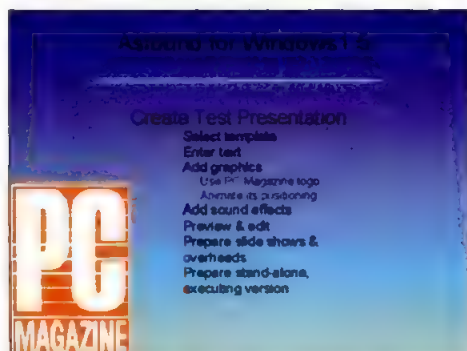
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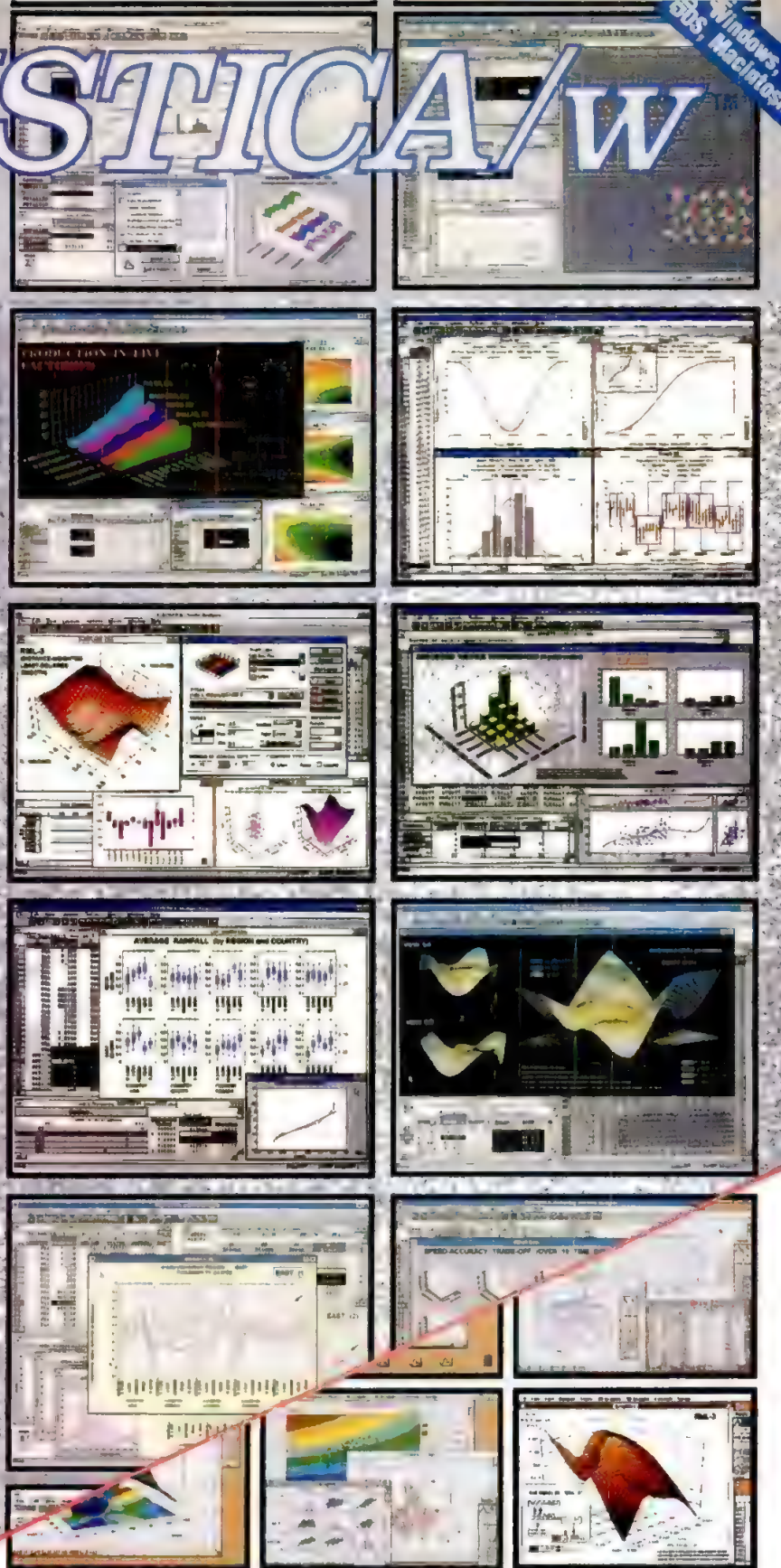


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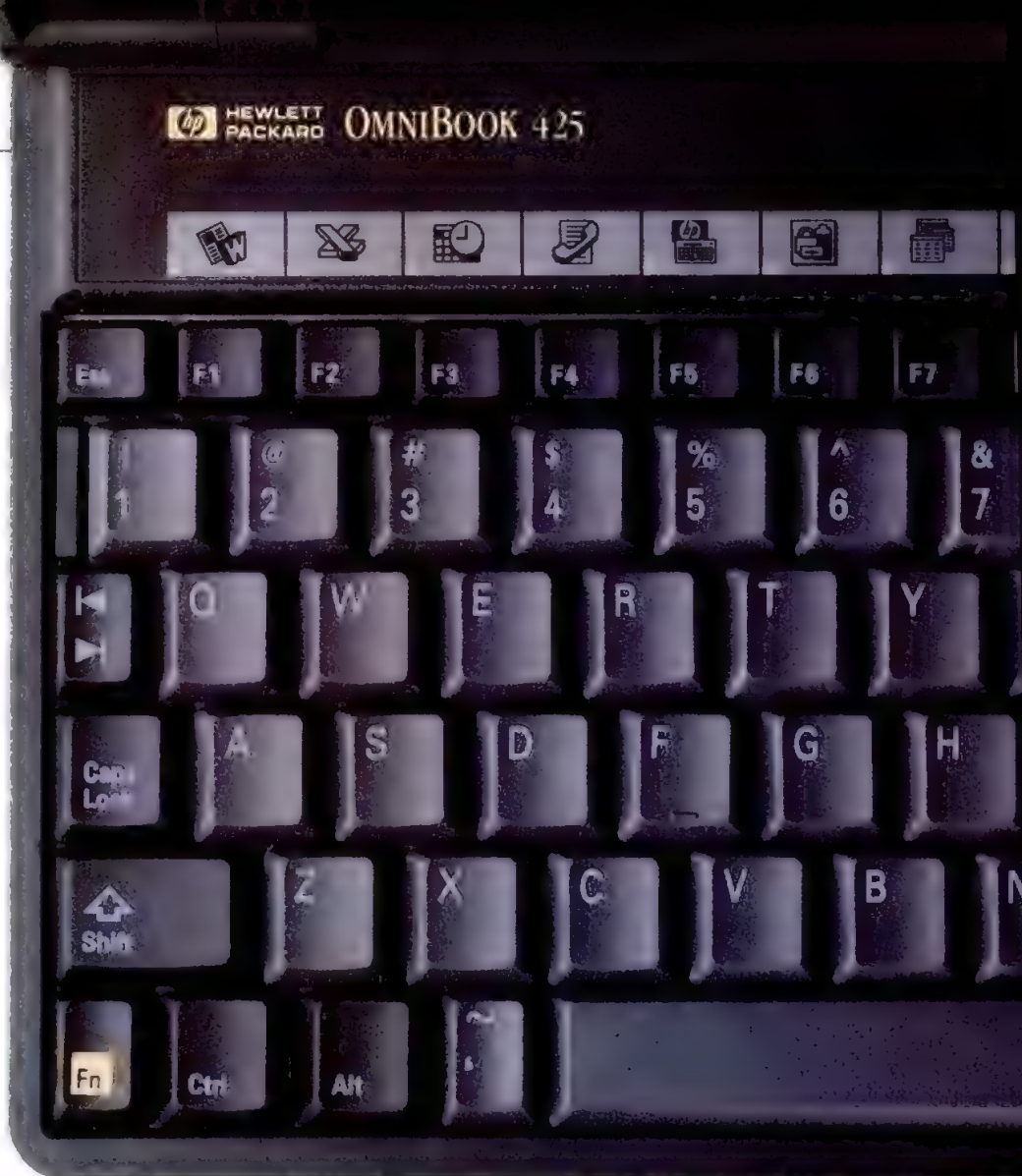
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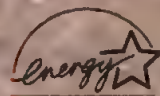
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CIRCLE 226 ON READER SERVICE CARD

New & Improved

NEWS OF ANNOUNCED PRODUCTS AND UPGRADES

By Anush Yeghazarian

NEW & IMPROVED

Two Solutions to the Video Conferencing Dilemma

InVision Systems Corp. and **Video Conferencing Communications** have released videoconferencing solutions with intriguing differences.

InVision 2.0 is a software-only product designed for use over LANs (local area networks) or WANs (wide area networks). It has IPX support and a real-time, preemptive multitasking engine that uses IPX or VxD-based TCP/IP stacks to move data. The software lets you set bandwidth from 56 kilobits per second to 512 Kbps and allows frame speeds from 1 to 15 frames per second. There's a visual address book and two video windows: You're in one, and your conferencing partner is in the other. An optional whiteboard application lets you and other conferees collaborate on shared files in real time. The program supports .BMP, .DCX, .GIF, .JPEG, .PCX, .Pict, .TIFF, and .WPG file formats.

VCC's three new products are a mix of hardware and software. The first, VCC ISDN-4, lets you include up to four locations in one videoconference and lets you see all four parties on screen at the same time at 24 fps. It requires no video server or phone bridge; the system works over the ISDN digital phone network and uses three add-on PC cards. The second product, VCC ISDN-2, is limited to two locations and transmits at 30 fps. The final package, VCC POTS, has two-way videoconferencing and works over regular phone lines. It uses two V.Fast 28.8-Kbps modems and transmits images at 15 fps. It includes real-time video compression and decompression boards along with the necessary software.

Two additional products from VCC, one a high-end DTVC System and the other a phone-based system, are scheduled for release at Comdex this spring.

- List price: *InVision, Version 2.0*, \$995; *Vision-Graphics*, \$195. *InVision Systems Corp.*, 8500 Leesburg Pike, #300, Vienna, VA 22182; 800-284-3364, 703-506-0094; fax, 703-506-0098. Circle 407 on reader service card

- List price: *VCC ISDN-4*, \$9,999; *VCC ISDN-2*, \$6,999; *VCC POTS*, \$3,999. *Video Conferencing Communications Inc.*, 36 Argonaut, Aliso Viejo, CA 92656; 714-452-0800; fax, 714-581-9271.

Circle 408 on reader service card

HOT PROSPECT

When Is a Network Server Not a Network Server?

Zenith Data Systems and **Novell** have announced the Z-STOR Personal Server, a turnkey PC-like server meant to satisfy the needs of small workgroups that require network functionality but can do without network costs and complications.

The Z-STOR is notable for both price (starting under \$1,000) and ease of use. Because the ZDS engineers have worked closely with Novell and because Novell's DOS 7 and Personal NetWare come preinstalled and pre-configured, no NetWare-certified engineer is required for setup. Additionally, the Z-STOR monitors its hardware and reconfigures itself when you upgrade it.

The system handles up to 20 users, provides full integration into other NetWare networks, and has SNMP support. It also has a watchdog program that can shut down the server and reboot when it senses an error, and there is an

optional PCMCIA card that can store the Personal NetWare OS in case of disk failure.

Systems come with 486SLC/25 CPUs, 2MB of RAM, 400MB or 1GB hard disks, two 5.25-inch SCSI bays, 10BaseT connectors, thick and thin Ethernet ports, one PCMCIA slot for Token-Ring cards or fax modems, a parallel port, and a SCSI-2 interface.

- List price: *Z-STOR Model 400*, \$999; *Model 1000*, \$1,599. *Zenith Data Systems*, 2150 E. Lake Cook Rd., Buffalo Grove, IL 60089; 800-553-0331, 708-808-5000.

Circle 403 on reader service card

NEW

Aquiline's Hurricane Spins In With An Integrated CD-ROM Drive

Aquiline's latest notebook, the Hurricane, has an integrated double-speed CD-ROM drive yet manages to weigh in at a relatively svelte 10

pounds. The unit

comes with a 486DX2/

66 CPU, 4MB of

RAM (expandable to

20MB), a docking sta-

tion connector, two Type II PCMCIA slots, a

built-in sound chip, a 3.5-inch floppy disk drive,

and a Powerbook-like integrated trackball.

Hard disks range from 200MB to 540MB and

are user-removable. You can choose mono-

chrome and color dual-scan passive-matrix or

active-matrix displays. The nickel hydride bat-

tery has a rated life of 3 hours.

- List price: *Aquiline Hurricane*, \$4,000 to 8,000. *Aquiline Inc.*, 701 River St., Troy, NY 12180; 518-272-0421; fax, 518-272-0547.

Circle 406 on reader service card



The Aquiline Hurricane with CD-ROM.

IMPROVED

The ABCs of FlowCharting Get Even Easier

The latest version of **Micrografx's** ABC FlowCharter, Version 3.0, includes expanded shape palettes, an automatic alignment tool, and OLE 2.0 support. It has connection lines that are quicker and easier to use and new keyboard shortcuts and hotkeys. The package also has a "basics" booklet to help you design your flowchart more effectively. Micrografx includes an automatic import filter for translating EasyFlow DOS charts to ABC FlowCharter.

- List price: *ABC FlowCharter 3.0*, \$495; upgrade, \$99. *Micrografx Inc.*, 1303 E. Arapaho Rd., Richardson, TX 75081; 800-676-3110, 214-234-1769; fax, 800-994-6475.

Circle 404 on reader service card

IMPROVED

QuickPay 3.0 Makes Pay Day Easier

Intuit's improved QuickPay 3.0 for DOS and Windows is designed to manage payrolls for small businesses without a fuss. New features include customizable payroll account/category names; tracking of employees' work, sick, and vacation hours; and, in the Windows version, batch check processing. The program also has three new payroll reports: a complete Payroll report with year-to-date employee earnings, withholdings taxes, hours worked, sick and vacation hours, and company payroll taxes; a Liability report with all payroll liability account balances; and an employee roster with addresses, telephone numbers, and social security numbers. Intuit also offers an optional 12-month, \$39.95 QuickPay Tax Table Update Service that keeps you up to date on any relevant changes to state or federal payroll tax codes.

• List price: *QuickPay 3.0 for DOS and Windows*, \$74.95; upgrade, \$34.95. Intuit Inc., P.O. Box 3014, Menlo Park, CA 94026; 800-624-8742, 415-322-0573; fax, 415-322-1013. Circle 410 on reader service card

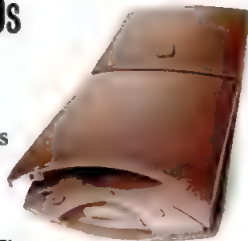
NEW

Take All Your CDs On the Road

Media Vision has released a portable CD-ROM drive for use with both desktop and portable computers. The Reno Personal CD-ROM Player, a double-speed drive with an 180-ms access time, connects to your system via a SCSI port. It runs with a typical AC connector or on eight nickel cadmium batteries (four when used only for audio CDs) that last for up to 2 hours with constant access. Designed for portability, it weighs 1.2 pounds with attachments and is 2 by 5.3 by 10.3 inches (HWD). The drives come in three different bundles: standalone, as part of a multimedia upgrade kit that includes a sound card, and equipped for connection to portables.

• List price: *Reno Personal CD-ROM Player*, \$399 to \$549. Media Vision, 47300 Bayside Pkwy., Fremont, CA 94538; 800-845-5870, 510-770-8600; fax, 510-770-9146.

Circle 409 on reader service card



The **Portable Reno Personal CD-ROM player**

BRIEFS

Hardware

STB Systems has released the \$199 Express PCI video card for Intel's PCI bus architecture. The card features a 32-bit local-bus interface and the Avance video chip set, plus 1MB of DRAM. Its graphics accelerator supports up to 16.7 million colors at 640-by-480 resolution. The maximum resolution is 1,280-by-1,024. 800-234-4334, 214-234-8750.

PreMax Electronics has a PCMCIA flash memory card for plug-and-play use with Apple's Newton or Sharp's ExpertPad. The PocketFlash comes in 1MB, 2MB, 4MB, 8MB, and 16MB varieties. Prices range from \$125 to \$995. 714-851-8242.

The **Apple/MegaHertz** alliance has delivered a PCMCIA modem for the Newton that handles 2,400-bps data (standard alphanumerics or handwritten messages from the pad) and 9,600-bps fax transmissions. The \$220 Newton Fax Modem Card has Megahertz's XJACK connector. 800-795-1000.

Solectek Corp. is offering a more general-purpose PCMCIA peripheral, the \$699 AIRLAN/PCMCIA. The AIRLAN/PCMCIA is the newest member of its AIRLAN wireless Ethernet product family. It lets you link to your LAN from anywhere within your building with no line of sight required. It is a Type II PCMCIA card that operates at 2 megabits per second and supports most major network OSs, including NetWare and Windows for Workgroups. 800-437-1518, 619-450-1220.

For those looking for an alternative to bar code readers, **TimeKeeping Systems** has The Pipe, a \$495 metal touch-memory button reader. It reads a unique ID number stored in each memory button and time-stamps them as it reads. Later, with the \$195 Downloader, the information can be transferred to a PC through the serial port at speeds up to 57.6 Kbps. The Pipe is made of stainless steel and can withstand temperatures from -20 to 125 degrees Fahrenheit. It's powered by a lithium battery and stores up to 64K of information. 216-361-9995.

IMPROVED

A Method to Multimedia Madness

Lenel Systems International has upgraded MpcOrganizer, its multimedia database organizer for Windows. Version 3.0 lets you view files from CD-ROMs or hard disks and over networks. It has a thumbnail viewing feature and handles numerous graphics and sound file formats including .AVI, .FLI, PhotoCD, and .WAV. It can also store a group of multimedia objects together and save storage space by using JPEG compression on graphics files (you control the compression/quality ratio). It can search for and retrieve objects based on filename, theme, or keyword, so you're not limited to DOS filenames in your searches. MpcOrganizer also lets you create customized databases with user-definable fields, and includes an audio CD Browser/Player and cataloging.

• List price: *MpcOrganizer, Version 3.0*, \$149; upgrade, \$59. Lenel Systems International Inc., 290 Woodcliff Office Park, Fanport, NY 14450; 716-248-9720; fax, 716-248-9185.

Circle 405 on reader service card

NEW

Electronic Braincel for Excel Purposes

Promised Land Technologies has released an upgrade to its neural-net-based Braincel product. The product is an add-in for Microsoft Excel and is used to develop predictions based on preexisting data or data created in your spreadsheet.

To create prediction results in a spreadsheet, you first create a Braincel neural-net "expert" by generating a grid of data points from historical results. Then you train the expert to predict future results based on the patterns within this existing data. Setting up and using this package is easy; understanding how many data points and how much "expert" training are required is harder, making a novice user's results questionable.

The company promotes Braincel 2.0 for Windows for applications such as forecasting financial market behavior based on certain economic and political indicators and keeping track of loan applications based on loan criteria. The spreadsheet metaphor and excellent integration with Excel make it attractive.

• List price: *Braincel 2.0 for Windows*, \$99. Promised Land Technologies Inc., 900 Chapel St., #300, New Haven, CT 06510; 800-243-1806, 203-562-7335; fax, 203-624-0655.

Circle 412 on reader service card

a shining example of the power the Windows interface has to make a complex activity easy to learn and productive to use.

There are many benefits...

— Computer Technology Review

ease of use starts with the "Friendly Accountant" (a little guy in a green eyeshade!) that walks users through setup and installation, and Smart Guides that help explain data fields and eases users into the program and accounting in general.

— Computer Technology Review

A dramatic new interface, new help functions and, more flexible, powerful money management functions make it hard to beat for small business accounting.

— PC Magazine

product I've seen. The program's new look incorporates state-of-the-art Windows conventions: descriptive icons, real-life representations of graphic forms, and visual flow charts that guide you through an accounting process.

— Home Office Computing

Accounting software developers have tried to do the impossible for years; wrap an intuitive simple, flexible interface and feature set around the rigid, cumbersome, complex process of double-entry bookkeeping. Peachtree Software's recently unveiled Release 2 of Peachtree Accounting for Windows (\$169) succeeds. Even when you consider its for...

— PC Magazine

PAW offers General Ledger, Accounts Receivable, Accounts Payable, Payroll, Inventory, Job/Project Tracking, Financial Report Writer, Custom Forms Design, Bank Reconciliation and Import/ Export. With its use of the MDI (multiple document interface) specifications, any and all of these modules can be open at once, each automatically updated as changes are made in any other. The program...

— Computer Technology Review

succeeds. Even when you consider its formidable competition, Peachtree's new cash management functions, ease-of-use features, and flexibility move the product ahead of the pack.

— PC Magazine

the program now uses less accounting jargon than the previous version—a real boon for the typical small business person. Other standout features well-int...

— Compute

more intuitive and full featured than any similar product I've seen. The program's new look incorporates...

— Compute

The best-selling Windows accounting software.

— As Reported In PC Week.

And it's multiuser straight out of the box.

Peachtree

— PC Magazine

For a small business that's ready to upgrade from a checkbook program, Peachtree Accounting definitely deserves a close look. ■

— Windows Magazine

Enough Said.



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Peachtree Accounting For Windows, Release 2.0

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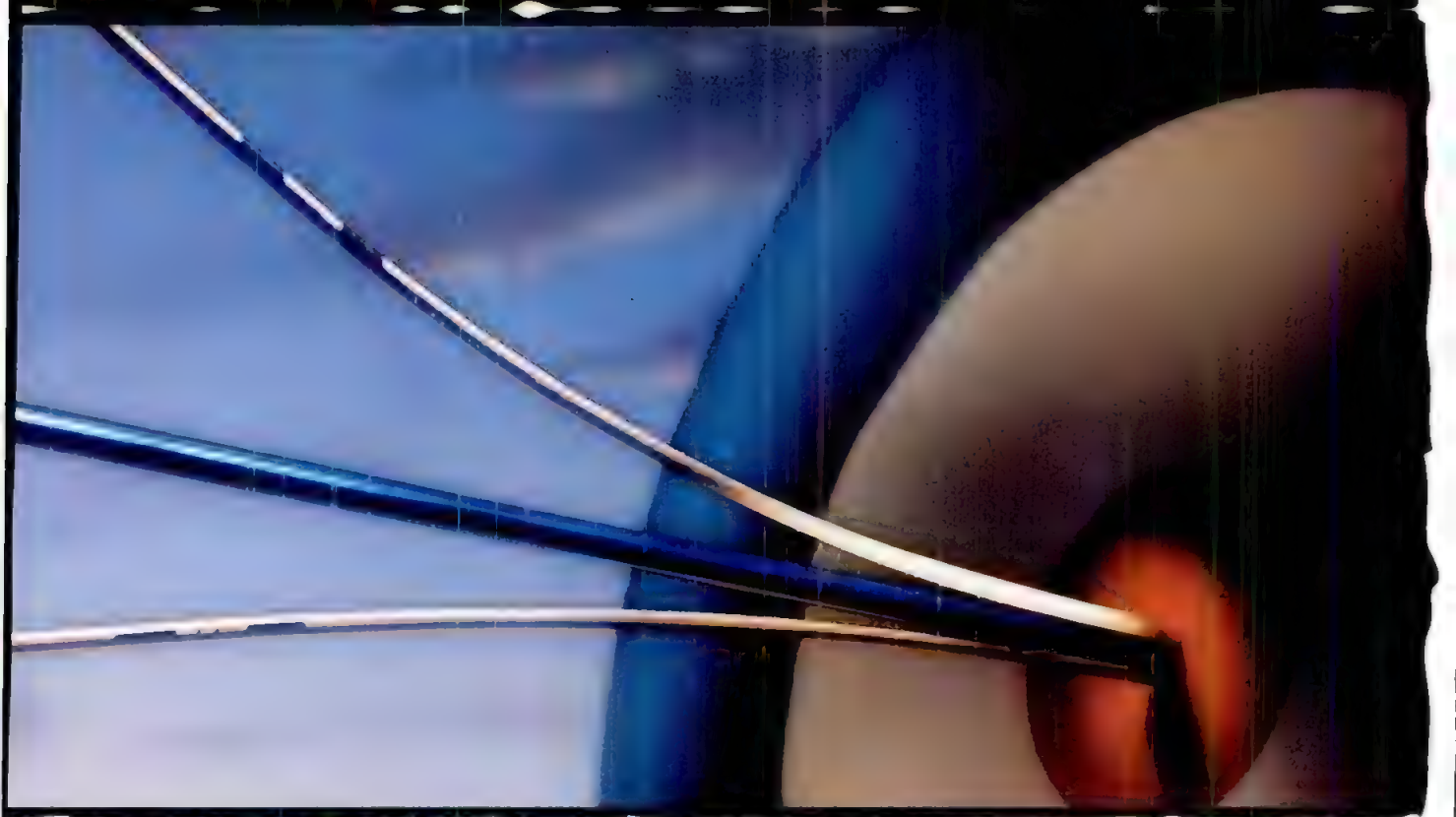
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more custom characters than ever before. In addition, Professional 5.0 contains all the easy-to-use features you've come to expect from the leader in OCR, including:

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3D OCR is a revolutionary technology that uses full gray images for the first time. Professional 5.0 is able to view the "depth" of each character pixel, so it can be used as additional "data" in the recognition

process. OmniPage also includes a new compound neural network to help with extra tough pages like faxes. In addition, Professional 5.0 features the Language Analyst™, a sophisticated language checker which eliminates many OCR errors.

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New & Improved

IMPROVED

Sure!MAPS' Detailed Maps Arrive in Windows

Horizon Technology has released a Windows version of Sure!MAPS 2.0, its CD-ROM-based desktop mapping software. The program's raster-based (as opposed to bit-mapped) maps are detailed and precise. It has basic drawing tools so you can annotate parts of the maps or add titles, and it lets you import street addresses or coordinate data from



Sure!MAPS 2.0 can show you raster-based maps or vector maps.

spreadsheet files or database files in .DBF format. The new Windows version also lets you open several different scales of a map at the same time and transfer plots made on the active window to the rest of the open windows. The basic product includes a continental map of the U.S. and two world maps. Additional topographical and street-level, regional, and satellite-image maps are available as options.

• List price: *Sure!MAPS 2.0*, \$199; *Regional map sets*, \$49; *Detailed map sets*, \$99; *SPOT Satellite Imagery map set*, \$499. **Horizons Technology Inc.**, 3990 Ruffin Rd., San Diego, CA 92123; 800-828-3808, 619-292-8331; fax, 619-292-7321.

Circle 414 on reader service card

NEW

3D Graphics Serves Up Three Clip Art Collections

Art a la Carte, **3G Graphics'** latest clip-art collection, comes in three sets: *Holidays & Fun*, *Office*, and *Out & About*. Each package includes 150 scalable images (both color and black-and-white), and the program lets you choose among CGM, Print Shop Deluxe, and .WMF file formats. "Smorgasborders," *Scene Cuisine* (backdrops), *Toppings* (headlines), *Snacks* (illustrations), and *Tidbits* (dingbats) are included in each collection.

BRIEFS

Hardware

Hewlett-Packard has new DAT drives and a high-capacity DDS-2 autoloader. The \$1,429 HP JetStore 2000i gives you up to 2GB of storage, and the \$643 JetStore 5000i provides 4GB with data compression. The latter drive is available as 5000e for \$3,714 in case you want an external drive. The HP C1553A-DDS-2 DAT Autoloader comes in a 5.25-inch size and holds six cartridges on a removable magazine. It has a native transfer rate of 510 Kbps, with an average access time of 90 seconds, and its cartridges can handle up to 8GB of data with compression. 800-826-4111.

Sejin America has released the \$74.95 Mini-Desk keyboard. The slim keyboard, designed to be identical to one of the keyboards the company sells to notebook manufacturers, measures 11.5 by 5.6 inches and has a \$25 optional, integrated, direction- and pressure-sensitive "J" mouse. The J key functions normally unless it is held down, in which case it becomes a pointing device. 408-980-7550.

Maxi Switch has gone the green route for its new keyboards. It has two new models: the \$39 Green Keyboard, a standard 101-key keyboard made of recycled and reusable materials; and the \$99 Ergonomic keyboard, a standard keyboard that you can split in two, with the larger part containing the 72 main keys and the other the numeric keypad, cursor and page keys. Both parts can be individually raised and locked for comfort. 602-294-5450

NMB Technologies is now marketing its Professional Series clicker keyboard through CompUSA. This standard PC-compatible keyboard is priced at \$80. 800-662-8321.

Software

StereoCAD has introduced the \$3,300 RT Texture, a photo-realistic virtual-reality program for CAD users. With RT Texture, you take an imported .DXF file and navigate through it in wireframe, shaded, or textured mode. The walk-throughs are controlled via mouse or stylus and can be recorded for instant animation. The program is also capable

• List price: *Art a la Carte*, \$49.95. **3G Graphics Inc.**, 114 Second Ave. South, #104, Edmonds, WA 98020; 800-456-0234, 206-774-3518; fax, 206-771-8975.

Circle 413 on reader service card

IMPROVED

PC Write Lives!

After going into limbo when its creator, Quicksoft, went out of business, **PC-Write** has found salvation through **Starlite Software Corp.**, which recently acquired rights to the product. The latest upgrade, Version 4.15, contains minor bug fixes. Starlite intends to keep making improvements to the program and to continue to offer it as shareware.

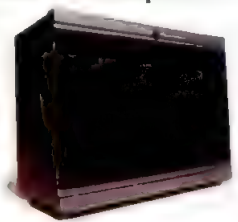
• List price: *PC-Write, Version 4.15*, as registered shareware with 30 days of support, \$49; with one year of support, \$69. **Starlite Software Corp.**, P.O. Box 370, Hadlock, WA 98339; 800-888-8088, 206-437-2650; fax, 206-437-0362.

Circle 415 on reader service card

NEW

New CD-ROM Jukebox Holds 100 Disks

Pinnacle Micro has released a 100-platter CD-ROM jukebox that stores up to 65GB of data. The Cascade CD 100 can store both audio and data-filled CDs and uses a double-speed CD-ROM drive to access them. It has a disk load time of 6 seconds. The unit is bundled with Pinnacle's PVFS (Pinnacle Virtual File System) software, which lets you access the library of stored CDs through both volume names and filenames.



Pinnacle Micro's Cascade CD-100 storage unit.

The Cascade is compatible with PCs and Macs, and supports a number of CD formats including CD-Bridge, CD-I, CD-ROMXA, and PhotoCD.

Pinnacle Micro also has four new magneto-optical storage systems, with capacities from 20GB to 186GB. They have 19-ms access times, data throughput rates of 2 megabytes per second, and 4,500-rpm rotation speeds. All include the PVFS file management system.

• List price: *Cascade CD 100*, \$9,995; *Alta-20GB*, \$9,995; *Aspen-40GB*, \$19,995; *Alpine-120GB*, \$49,995; *Mammoth-186GB*, \$79,995. **Pinnacle Micro Inc.**, 19 Technology, Irvine, CA 92718; 800-553-7070; fax, 714-727-1913.

Circle 416 on reader service card

The Apple Report On PowerPC

NUMBER 3 — APPLICATIONS ACCELERATED FOR POWERPC

If you buy a Macintosh today, can you upgrade it tomorrow? In many cases, yes. Just look for the "Ready for PowerPC upgrade" sticker on the box.

On average, a Macintosh with PowerPC technology achieves two to four times the performance of 68040 and 80486 machines running the same programs.

If you use applications that do floating-point mathematical calculations, your performance levels could be up to ten times those of the same program running on a 68040 machine — and several times faster than the fastest Pentium system — based computers.

A Macintosh with PowerPC offers unprecedented compatibility between Macintosh, MS-DOS and Windows, thanks to an emulation program called SoftWindows, which licenses Windows code from Microsoft.

For more information about Macintosh with PowerPC, call 1-800-732-3131, ext. 150. We'll send you a free copy of *PowerPC Technology: The Power Behind the Next Generation of Macintosh Systems*. In Canada, call 1-800-665-2775, ext. 910.

The new family of Macintosh® computers with PowerPC® chips will run virtually all Macintosh system-based software and most current programs for MS-DOS and Windows operating systems.* So no matter what computing environment you're working in now, you can migrate to a more powerful desktop computer without losing your investment in your current software.

But the real benefit of PowerPC technology will be seen with new applications optimized to take advantage of the chip's advanced capabilities.

These applications, often called native applications, will offer two to four times the performance of programs available for the fastest Macintosh computers today. Developers writing native applications say that these applications perform at levels better than their Windows counterparts running on Intel Pentium system-based computers.

Major developers on board.

Right now, the world's leading developers are updating their most popular and memory-intensive programs to take full advantage of PowerPC technology.

In fact, Apple has been working closely with more than 200 major third-party developers since 1992 to create powerful new versions of their applications.

And since software development kits became widely available in January, hundreds of additional developers have begun the move to PowerPC.

PowerPC technology enables them to incorporate new levels of speed and functionality into their applications for the Macintosh system. Developers everywhere are eager to exploit these new capabilities.

Do more in less time.

What will the advanced capabilities of native applications mean to you? You'll spend significantly less time waiting for your computer to redraw or recalculate or re-anything. That means you'll have more time to create and refine your work, to apply new concepts, to test options.

You can also expect to see new kinds of applications — software that is both more intelligent and easier to use.

Developers will be exploring new features in areas such as intelligent help, 3-D design, video, animation, speech recognition and text-to-speech conversion.

Many of these new functions simply wouldn't be practical without the superior processing capabilities of a RISC chip and innovative Macintosh technology.

Why RISC?

The new generation of Macintosh computers will be the first personal computers with RISC (Reduced Instruction Set Computing) chips — ultra high performance chips that were previously available only in workstations.

(In fact, many workstation developers are now writing applications for the Macintosh platform for the first time.)

RISC chips are smaller and less complex than comparably powered CISC chips, so they cost less to produce — which means that Macintosh computers with PowerPC technology can offer a significant price/performance advantage. But more important, they'll give you an unprecedented

new kind of power.
The power to be
your best.™



What programs will be ready?

While a Macintosh with PowerPC technology will run virtually all of your existing Macintosh system-based programs, the real benefit of PowerPC will be with applications optimized to take advantage of the chip's advanced capabilities. More than 50 of these native applications will be available in the first half of 1994. Here are some of them:

ACI 4th Dimension	Frame FrameMaker
Adobe Dimensions	Insignia Solutions SoftWindows
Adobe Illustrator	Microsoft Excel
Adobe Photoshop	Microsoft Word
Adobe Premiere	Specular Infiniti-D
Aldus FreeHand	Strala StudioPro
Aldus PageMaker	VideoFusion VideoFusion
Alias Sketch!	Virtus WalkThrough
Claris ClarisWorks	Wolfram Mathematica
Fractal Design Painter	WordPerfect WordPerfect



*Adding SoftWindows from Insignia Solutions Inc. lets you run MS-DOS and Windows on Macintosh with PowerPC. Apple will offer some configurations with SoftWindows bundled and ready to run. If you choose a model without SoftWindows, you can purchase the program later and add it then. © 1994 Apple Computer, Inc. All rights reserved. Apple, the Apple logo, Macintosh and "The power to be your best" are registered trademarks of Apple Computer, Inc. PowerPC and the PowerPC logo are trademarks of International Business Machines Corporation, used under license therefrom. MS-DOS is a registered trademark of Microsoft Corporation.

New & Improved

NEW

Octopus Reaches Out to Safeguard Your NT System

P&W Technologies provides real-time data backup for Windows NT with its Octopus software. The program automatically and transparently mirrors data by monitoring transactions and instituting a file backup whenever it detects that a selected file has been changed. It handles up to 30 transactions per second and lets you choose any local or remote physical drive as the backup destination. The program works with X.25, TCP/IP, and other communications protocols supported by Windows NT, and it is available on any platform that supports Windows NT.

• List price: *Octopus*, \$3,975 (5 clients). *P&W Technologies Inc.*, 8 Meadowbrook Ln., #8, Chalfont, PA 18914; 800-919-1009, 215-822-8075; fax, 215-822-5965.

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IMPROVED

Add Bar Codes to WinWord Documents

Tippecanoe Systems' latest bar-coding program, *Bars & Stripes for Word* for Windows 6.0, adds three new bar codes, EAN-8, EAN-13, and UPC-E, as well as the previously undocumented Code 39. It also includes software for calculating the full delivery-point bar codes required by the U.S. Post Office. All of Tippecanoe's bar-coding programs work through versions of Microsoft Word for Windows or WordPerfect (a WordPerfect 6.0 version is now available). An upcoming version for Microsoft Access will support the same set of bar codes as the word processing versions.

• List price: *Bars & Stripes for Word* for Windows 6.0, \$99; upgrade, \$49; *Bars & Stripes for MS Access*, \$99. *Tippecanoe Systems Inc.*, 5674 Stoneridge Dr., #119, Pleasanton, CA 94588; 510-416-8510; fax, 510-416-8516.

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NEW

The Pinnacle of OS/2 Desktop Management

Binar Graphics has released *SkyScraper*, a desktop manager for OS/2 that lets you sort your applications into multiple desktops and keep them on a floating toolbar for one-button access. It also lets you launch any pro-

BRIEFS

of multiple animations, color editing, and texture editing. 408-245-5201.

Baarns Consulting Group has released *The Baarns Utilities 5.0* for Microsoft Excel. The new \$89.95 add-on has an auto-dialer, as well as enhanced versions of its 23 other utilities. It works with Excel 4.0 and 5.0 and is available to registered users of *The Baarns Utilities 2.0* at no additional cost. Users of Version 1.0 can upgrade for \$19.95. 800-377-9235, 818-364-6148.

Software

Boca Wipe Out is **BocaSoft's** answer to those wanting *After Dark* in OS/2. This module lets you run any of Berkeley Systems' *After Dark* screen savers from within OS/2. It's a free module and can be downloaded from the BocaSoft Forum in CompuServe. You can also receive it from Indelible Blue Inc. for a \$5 shipping and handling charge. 800-776-8284, 919-934-7005.

Creative Systems Programming has released *Golden CommPass 2.1*, a \$99 CompuServe navigator for OS/2. It lets you customize and automate your CIS on-line sessions, letting you make choices about what to do on-line before you get on-line. It has features such as Intelligent Subject Marking, which remembers and marks message threads previously selected or skipped, and Message Archiving. You can also use *CommPass 2.1* to send messages with attachments, and it lets you include carbon and blind carbon copies. Upgrades are \$49. 609-234-1500.

Blazie Engineering has developed the \$495 *Windows Master*, a program that gives blind or visually impaired users access to Windows. It requires a synthesizer. 410-893-9333.

Aristo-Soft has released the \$29.95 *Talking Icons 2.0*. The new version of the Windows personalization software has seven new utilities, among them *Windows FX*, which lets you animate menu buttons and title bars, and four *After Dark*-compatible *Nature Screen Savers*. It also has *Icon Motion*, which lets you display one of 50 animated icons, and *ICM Edit*, a simple icon editor. 800-338-2629, 510-426-5355.



SkyScraper lets you create a floating toolbar with multiple virtual desktops.

gram (or even a full DOS session) by dragging it onto one of the toolbar desk buttons that you have created. *SkyScraper* can handle multiple, fully maximized programs so that you don't have to keep switching or minimizing applications, and it remembers your configurations.

• List price: *SkyScraper*, *Desktop Manager* for OS/2, \$99. *Binar Graphics Inc.*, 30 Mitchell Blvd., San Rafael, CA 94903; 800-228-0666, 415-491-1565; fax, 415-491-1164.

Circle 419 on reader service card

NEW

PCMCIA Drives Hit the Desktop

With **Novacor** new PCMCIA read/write adapters, you can use your notebook's PCMCIA cards in your desktop system. These 3.5-inch drives fit in any normal drive bay and are also available as external peripherals. The drives hold two PCMCIA cards (Type I, Type II, or Type III), and you don't need to reboot after adding or removing a card. The Model PCMM-735 supports hardware memory and BIOS-level utility cards, while the Model PCMI-365 adds support for I/O, hard disk, and flash disk cards.

If, on the other hand, you want to add some of the peripherals available to your desktop to your portable, there's **Adaptec's** *SlimSCSI*, a PCMCIA Type II or III card that gives your portable a 16-bit SCSI interface. It has a data-transfer rate of 2MB per second and lets you daisy-chain up to seven SCSI devices like CD-ROMs or tape drives with it.

• List price: *Novacor Model PCMM-735*, \$275; *Novacor Model PCMI-365*, \$245. *Novacor Inc.*, 1841 Zanker Rd., San Jose, CA 95112; 800-486-6682, 408-441-6500; fax, 408-441-6811.

Circle 420 on reader service card

• List price: *SlimSCSI* kit, \$349. *Adaptec Inc.*, 691 S. Milpitas Blvd., Milpitas, CA 95035; 800-442-7274, 408-945-8600; fax, 408-262-2533.

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REVIEWS OF THE LATEST BOOKS FOR THE PC USER

Edited by Lance Ulanoff

PageMaker 5.0 Guideposts Address Many User Levels

LUISA SIMONE

Even though the latest version of Aldus PageMaker—5.0—has added power tools for professional artists, it still remains easy enough for beginning designers to master. So it's no surprise to learn that there are several books on the market that

address PageMaker's amazingly diverse collection of users.

If you learn visually rather than verbally, you'll love *Visual Quickstart Guide: PageMaker for Windows*, by Carrie and Paul Webster. An ideal reference guide, this compact book (about 250 pages) is chock-full of pictures that show you how to operate PageMaker. For example, seven pictures of seven different dialog boxes walk you through the process of creating defined styles. Highlighting, blowups of details, and lots of simple designs make the pictures almost self-explanatory. Of course, there are words in this book, but they take the form of annotations and long captions rather than running text.

PAGING THE TEACHERS

Teach Yourself PageMaker 5.0 for Windows, by David Browne, picks up where the Quickstart Guide leaves off. Also intended for novice users, this book is distinguished by its leisurely pace, entertaining language, and in-depth information. For example, Browne always lists the appropriate keyboard shortcut for a

command or the exact degree of precision of which a tool is capable. He also takes the time to detail how PageMaker's functions relate to traditional typography and prepress techniques.

Browne does a great job of explaining PageMaker's basic features. Six full pages are devoted to threading and unthreading

text blocks. Unfortunately, he misses important opportunities to discuss the functions that are new to Version 5.0. For example, in several cases—such as the use of multiple

paste or creating drop caps—Browne describes workarounds that were necessary in Version 4.0, even though a new feature in Version 5.0 handles the task automatically. While all of PageMaker's new functions are documented in an appendix, this information feels as though it were tacked on rather than fully integrated into the main body of the work.

If you are already proficient with earlier versions of PageMaker, you should definitely look into Jay Cosnett's book, *PageMaker 5.0 for Windows: Techniques and Applications*.



Read Only Recommends

When we're not computing, we're sailing. Or is it both? *The Seagoing Computer*, by Randall Brink, \$17.95. International Marine/McGraw-Hill, 800-233-1128; ISBN: 0-87742-364-4.

Three Tips from PageMaker Masters

"Paste Special Command: Use the Paste special command to activate the Paste special dialog box. Often when you cut or copy an object to the Windows Clipboard, the object is stored in more than one format. When you use the Paste command to insert an object, PageMaker will take the format that displays the truest image."—*Visual Quickstart Guide: PageMaker for Windows*, page 37.

"You can change highlighted text to All Caps by pressing Ctrl-Shift+K and to All Small Caps by pressing Ctrl-Shift+H."—*Teach Yourself PageMaker 5.0 for Windows*, page 64.

"You can speed the creation of a customized text wrap boundary by holding down Spacebar as you adjust the boundary. This temporarily prevents the text from rewrapping as you make each change. The text rewraps when you release Spacebar."—*PageMaker 5.0 for Windows: Techniques and Applications*, page 156.

Cosnett doesn't waste any of his 500-plus pages on basic instructions. Instead, he concentrates on Version 5.0's new features and on productivity enhancements. An entire chapter devoted to working with service bureaus includes money-saving tips as well as a thorough discussion of potential pitfalls.

Cosnett is clearly an experienced desktop publisher. As such, he includes topics—and criticisms—in his book that are not found in other publications. Cosnett's discussion of the Additions that are bundled with PageMaker includes their limitations as well as their benefits.

Cosnett also spends time on

the Windows Recorder and PageMaker's new script language—two methods that can automate repetitive tasks. Though they can't replace the official PageMaker Script Language Guide (which must be ordered directly from Aldus), Cosnett's scripting

dictionary, step-by-step instructions, and sample scripts (provided on-disk) can help you to work both faster and smarter.

• **Visual Quickstart Guide: PageMaker for Windows**, by Carrie Webster with Paul

Webster, \$14.00. Peachpit Press, 510-548-4393; ISBN: 1-56609-034-2.

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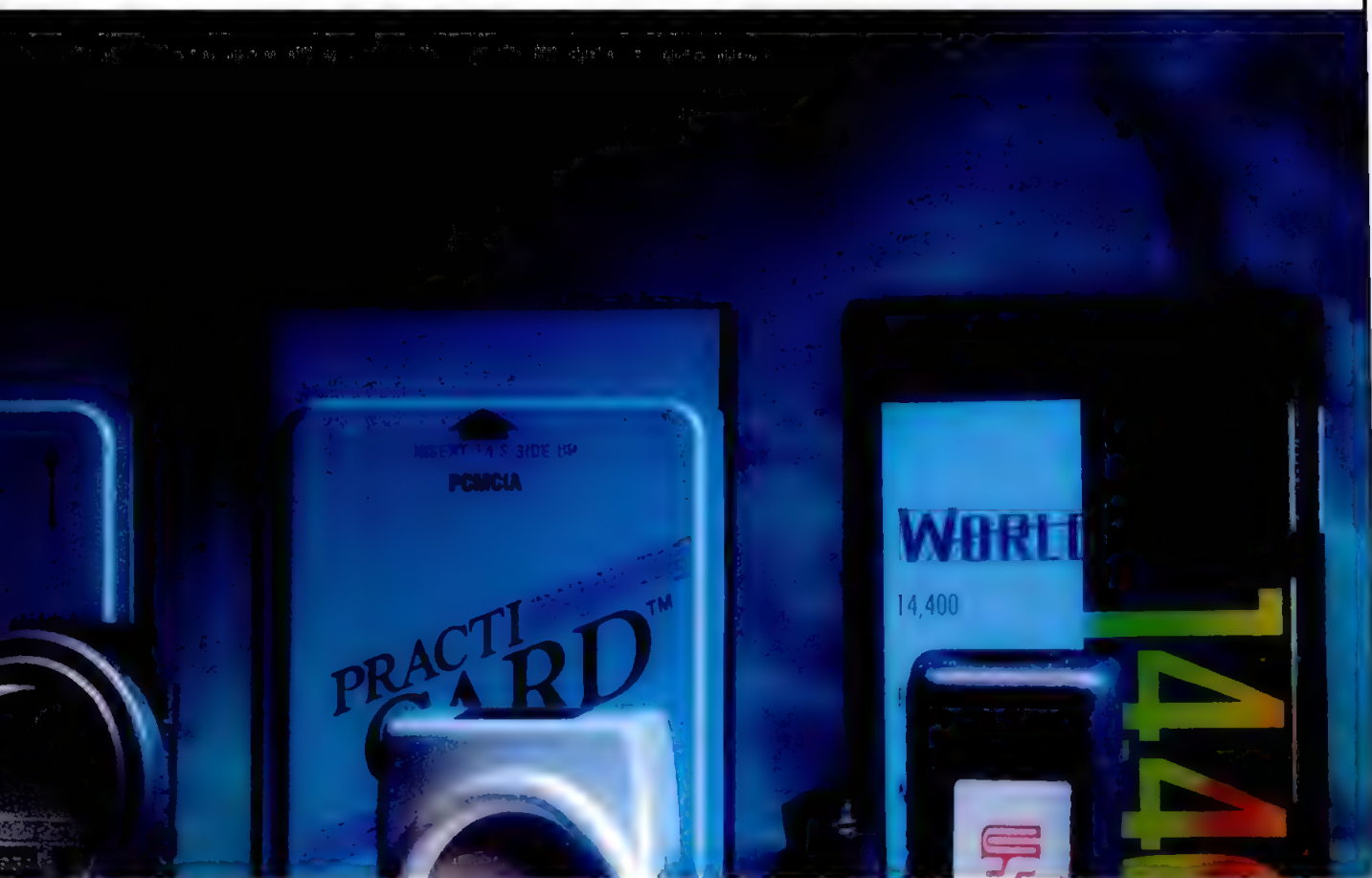
• **Teach Yourself PageMaker 5.0 for Windows**, by David Browne, \$21.95. MIS: Press, 800-628-9658; ISBN: 1-55828-245-9.

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• **PageMaker 5.0 for Windows: Techniques and Applications**, by Jay Cosnett, \$29.95. MIS: Press, 800-628-9658; ISBN: 1-55828-287-4.

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Michael J. Miller

The Long and Winding Road

It's almost impossible to avoid. Everywhere you go you hear people talking about the "electronic information superhighway." But what I want to know is: Where does this highway go? And what are the rules of the road?

My guess is that long before this highway stops at every home in America, it's likely to stop at every business. I do think it will make it to the home eventually, but it will be a long time before the demand is strong enough to make it economically feasible to put in the new wiring, set-top boxes, and network servers that the highway will need.

Remember, cable television was technologically practical long before it became economically practical. It has taken nearly 20 years for cable technology to become as commonplace as it is, and it's still nowhere near as ubiquitous as telephones or broadcast television. And despite all the talk of home shopping, electronic newspapers, and the tremendous availability of pay-per-view movies, very few homes today take advantage of them—even when they're just a few remote-control buttons away.

BUSINESS FIRST

In contrast, the case for being able to link up businesses anywhere is much clearer. Most businesses have already discovered the benefits of personal computers, and most PC users are already connected to some sort of network. Electronic mail is already common in the business world. Connecting an in-house electronic mail system to the outside world isn't trivial, but it's nothing new.

Everywhere you look, companies are putting in electronic connections to other companies. Additionally, companies are making connections to online services such as CompuServe or MCI Mail, and they have even begun to make direct connections to the Internet.

The reason is simple enough: Once you get used to electronic mail within

your organization, the natural thing is to want to send e-mail to business contacts in other organizations. It tends to make communications smoother and faster, improves service, and helps you understand your customers better.

All of this is happening today. Yes, it's a bit awkward (some Internet addresses can be very complicated). Yes, we need better mail services and network management tools. But it's happening, and without a whole lot of central planning, rules, or regulations. The demand for basic, simple electronic mail connections is there, and I expect that in the next year or two, almost any business that has e-mail will be able to send messages to any other business that has e-mail.

This isn't surprising. After all, businesses were the first big users of telephones and fax machines. Both are point-to-point communications media, and so is electronic mail. In many cases, e-mail is simply replacing the telephone or fax machine.

On the other hand, homes—not businesses—are the biggest users of media that's aimed at a wide audience, such as television and videos. At the office, text-based electronic communications may be enough, but at home, people want broadcast-quality video. This makes the situation at home significantly more complicated, because what we're talking about is a *lot* more bandwidth.

A PIECE OF THE ACTION

The scramble to bring that wide data path to your door is underway: Local phone companies, long-distance phone companies, and cable television suppliers are all jockeying for position. This is one of the main reasons for all the alliances we've seen in this area recently. Everyone sees the profits that cable TV com-



The information highway will eventually lead to your door, but not until you decide what you really want it for.

Michael J. Miller

panies are making, and everyone wants a piece of the action.

But there's a big difference between the way phone and cable companies work, and that difference is at the heart of the debate of what the information highway should look like. Phone companies let you talk to anyone else who has phone service. You can talk to people across the street, across the country, or around the world. It doesn't matter if they have a different local phone service or long-distance carrier. You simply pick up the phone and dial. That's the way we want e-mail to go and, in fact, the way I think we'd like to see all electronic communications work. It's great for point-to-point communications.

Television and cable TV companies follow a very different model. They are designed for mass-market delivery. You can tune in on any of the dozen or so channels that might be broadcast, or the 70 or so that are available via cable.

Even with 500 channels and video-on-

demand services, you'll still get a very limited number of connections, each trying to reach a broader audience. An individual typically has a very difficult time getting exactly what he or she wants.

It seems to me that in the long run, we'd be better off with the phone company model—where anyone can contact anyone else who is connected—than with the cable model, which is designed for a few providers to reach many viewers. This argument will go on for years, with the federal government likely to get involved in either regulating the information that will be available (in the cable model) or making sure the highway is open to everyone (in the telephone company model).

My guess is that we're likely to see a little of both, as the technology continues to evolve faster than the regulations. That's probably good. Look at today's on-line services and at the Internet. Both evolved with little thought about regulation and as a result offer a tremendous amount of information.

Much of the data you can get on such services is now made for business users because the benefits of such things as electronic mail, news feeds, stock market

quotes, and business databases are very clear. Similarly, we are beginning to see the kinds of services that make this attractive to individuals—mail and conferences, of course, but also things like on-line shopping, airline reservations, and home encyclopedias.

HOME SWEET HOME

Still, it's hard to say what kind of content will make the electronic information highway a necessity in every home. Is it pay-per-view movies, where the network replaces the local video store? Is it at home shopping? Is it video phone calls to the grandparents? No matter what, we'll probably need to make video-quality on-line services commonplace.

How will the highway reach your home? I don't know, and neither does anyone else. All we know is that the technology is evolving to allow for these kinds of applications, and as a result, people think there will be a demand. My guess is that the actual applications that drive people to install this kind of technology in their homes won't be exactly like anything that's being envisioned today. After all, 30 years ago, who would have predicted MTV? □

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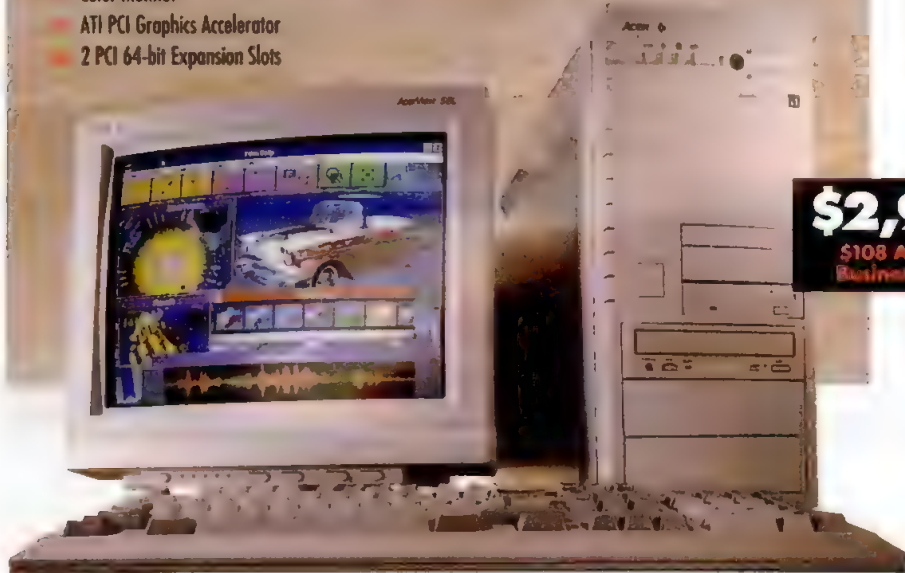
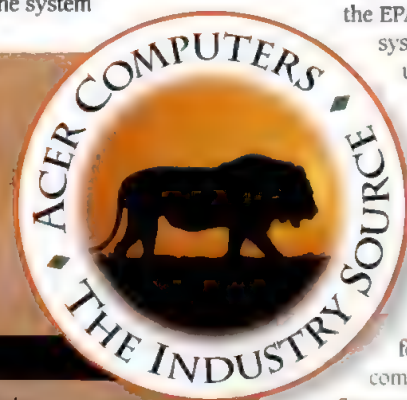
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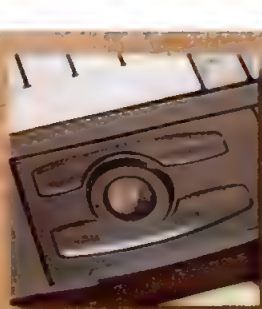
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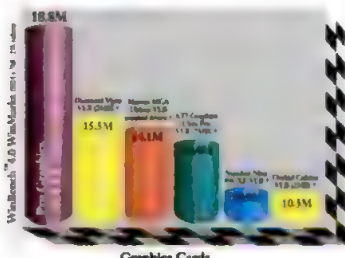
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Bill Machrone

The End Is Near

Strange things are happening. Heavy rains are causing devastation all over the world. Neptune is farther from the Sun than Pluto. My kids are eating their vegetables. IBM and Apple are selling computers that use the same CPU.

Meteorologists and astronomers can explain the first two, and I don't have a clue about the vegetables, but I'm going to try to explain the last one.

The enmity between Apple and IBM is ancient and time-honored. It touches every aspect of the companies' products and philosophies: top-down versus bottom-up, business versus home, character versus graphic. As these markets grew, the inevitable convergence changed both companies: IBM adopted graphical user interfaces and tried for the home market, Apple pursued the corporate market. Despite the increasing similarities, however, Apple computers maintained an ineffable aura of superiority. That superiority carried a price tag, and as the similarities grew, less discerning consumers were unwilling to pay the difference.

An army of seers, swamis, and prognosticators could not have predicted what the two companies decided to do about it: They joined forces. IBM and Apple formed Taligent to write the next great operating system, and they agreed to codevelop (with Motorola) the next great microprocessor—the PowerPC. Given the ever-increasing speeds of the Intel and the Motorola processors, a new CPU chip seems like an answer to a question that no one is asking. Such is the nature of market leadership.

Apple and IBM command less than half the desktop market, yet they propose to create an alternative standard that will set the industry on its ear. The big news about the PowerPC is that it's a RISC chip. RISC dates back to some work done by IBM researchers, who found out that most programs use only a small subset of the machine-language instructions available. By implementing only the most commonly used instructions, chip designers could build

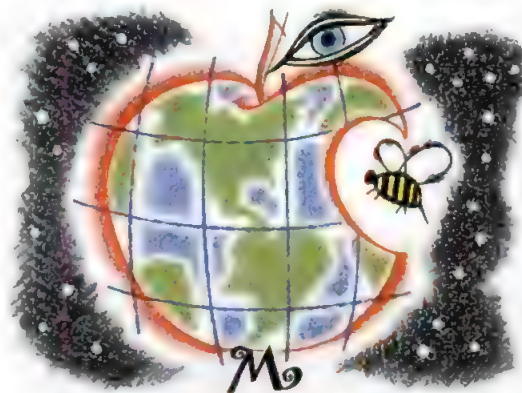
processors that were significantly smaller, cheaper, and faster. CISC (complex instruction-set computing) chips might offer more conveniences to programmers, but any roomful of hackers will always vote for speed over convenience.

IBM and Apple are not entering this relationship on an equal footing. Apple is converting its entire product line to the PowerPC, while IBM will continue to build Intel-based machines for as long as there is a market, giving you significant choices. It's not that IBM is any less committed to the PowerPC, but IBM would be foolish to pull back from a market that it has successfully reentered. IBM's covered bet is this: If the market is tired of Intel dominance, IBM wants to be sure it has a hand in the change of power. After all, IBM's choice of the 8088 for the original PC *made* Intel; what better move than to crown the next king?

The RISC-versus-CISC battle lines have been drawn. Now we get to watch it play out in the marketplace. The RISC proponents say RISC will bring us higher-performance computing at a lower price. It's true that the raw cost of a RISC CPU for a given performance level will be lower, but all the other components in the system have to match the CPU's performance. The faster the processor, the more components cost. The price difference won't be all that great.

The real test of whether the world is ready for RISC is software portability. There's no way that the RISC proponents can ignore the enormous installed base of Intel-based software. They need to provide emulation, portable APIs, and binary recompilation.

Emulation means imitating the Intel instruction set on the PowerPC. Emulation has gotten very fast, but it's never as fast as the real thing. Portable APIs,



*IBM and Apple? Working together?
What's the world coming to?
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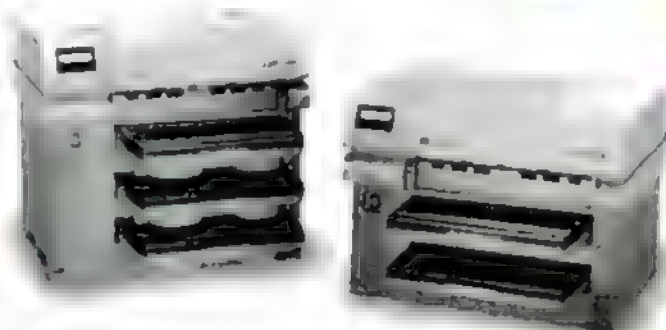
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Bill Machrone

notably WABI (Windows Application Binary Interface), are with us, although not entirely bug-free. With a portable API, calls to the operating system look the same no matter what processor is underneath. The biggest obstacles to portable APIs are undocumented calls and incorrect documentation. You have to build in all the bugs of the system you're imitating, too. Binary recompilation seems like magic: You examine the binary object code and recompile it into new object code that runs on a different processor. Given the complexity of most commercial programs, that this works at all is nothing short of a miracle.

AN OS OF THEIR OWN

Those steps will take care of the installed software base, but a portable operating system that is accepted by both RISC and CISC users is even more important. Windows NT is the most obvious candidate, but IBM's WorkPlace OS and Taligent's Pink will bear careful watching.

Software vendors will still have to recompile their applications to run on the PowerPC under NT, but this is simple and straightforward. The key is getting them to want to do it. I believe that the combined market presence of IBM and Apple will make PowerPC the dominant RISC platform in short order and that software vendors will be eager to support it.

Having the ability to run Windows programs will be critical to the acceptance of the PowerPC, and using NT is the way to do it. But IBM and Apple won't feel that they've gained anything if they remain beholden to Microsoft. Therefore, they're pressing ahead with their own operating systems.

During all this, Intel won't be standing still, and neither will cloners AMD, Cyrix, and Texas Instruments. They'll all be building faster x86 chips and driving costs down to wed themselves further to the installed base. Sun's SPARC, SGI's R4000 family, and Digital's Alpha are also RISC contenders, but the PowerPC has the right parentage and enormous momentum.

Over the next three years, the chip wars will send off shock waves that will shape the next century. Fortunes will be won and lost as cataclysmic events roll through the industry. Ultimately, the very forces that drove IBM and Apple together could drive them apart, causing even greater upheavals.

Strange things indeed. Repent, sinners. ☐

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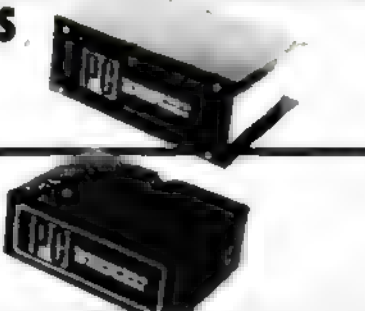
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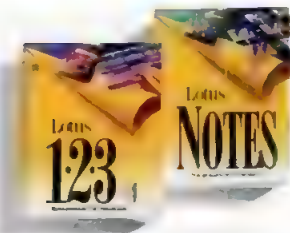
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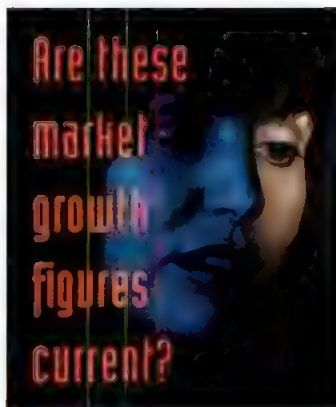
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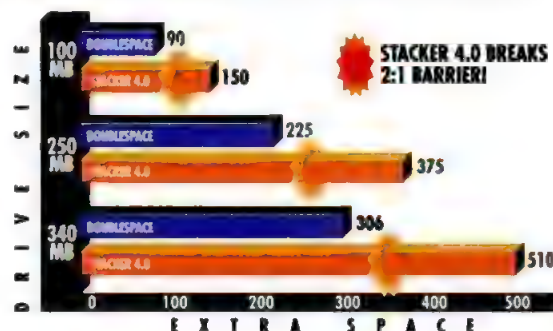


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John C. Dvorak

The True Horror of Windows

Let me explain what may be the most roundabout way ever devised to beat a competitor into submission and how this strategy adversely affects the entire computer industry.

This is going to be a bit complicated, but bear with me.

Device independence is part of the Windows architecture. It was initially sold to a gullible public as a good idea, because all peripherals would talk to Windows with one device driver and all software would talk to Windows through one API. How marvelous. Device independence does sound like a good idea, but it spells doom for today's users. Thanks to this philosophy, there's little chance your old peripherals will work with a new operating system. Wait until Windows 4.0 comes out! If you want to use that discontinued video card, CD-ROM, or printer on your new machine, you can forget it. Can you spell D-U-M-P-S-T-E-R? Ever wonder why the hardware vendors love Windows?

In my opinion, the initial purpose of device independence was to enable Microsoft to wrest the word processing business away from WordPerfect—permanently. Confused yet?

In the days before Windows, software had to support whatever devices (mainly printers) were out there. If there were a lot of Epson printers, the application developer would provide Epson drivers, which the user would install. Today, applications talk only to Windows, and Windows in turn talks to the printer. It's the printer manufacturer that provides a driver.

Suddenly, the job of writing drivers has shifted from software companies (who do software best) to hardware companies (who seldom do software well). This explains why most of today's drivers are so miserable. More important, device independence has managed to shift hardware vendors' orientation from supporting the installed base to selling new products. Vendors write drivers for current products rather than waste resources on drivers for old dogs that are discontinued. (And the lack

of drivers for OS/2, despite nearly 3 million users, proves that hardware companies are no longer interested in broad support for their products.) So as operating systems evolve and require new device drivers, the older peripherals won't work, because there'll be nobody writing drivers for them. You can kiss your hardware investment goodbye.

Anyway, the most interesting aspect of all this is the purpose it serves Microsoft. When software companies had to write device drivers, support-oriented companies had an edge. This was especially true for WordPerfect, which has a listing of printer drivers for its DOS-based products that's the size of a Manhattan phone directory. Once WordPerfect is forced to switch into the new world of device independence, it loses its edge. All that work for nothing.

Until the Windows breakthrough, Microsoft could never compete with WordPerfect in word processing. Microsoft managed to wrest the spreadsheet market from Lotus and is close to dominating the database scene. But capturing the word processing market was elusive. WordPerfect's reputation for service and amazing printer support kept it on top. Microsoft's device-independence

gambit essentially pulled the rug out from under WordPerfect. It's an amazing accomplishment that even WordPerfect doesn't fully understand; its discontinuation of an OS/2 line suggests that WordPerfect is almost rooting for Microsoft.

This is certain: The ones who suffer the most are users on tight budgets who want to upgrade their operating systems. People won't upgrade anything. Instead, they'll use what works on the old machines with the old peripherals. As for WordPerfect Corp., I wish it luck.



How Microsoft got us into an endless hardware-upgrade loop and pulled the rug out from under WordPerfect.



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Inside Track

Well, Intel is finally shipping its **clock-tripled 486**. Now you'd think that since the clock-doubled 486 is dubbed the DX2, the clock-tripled 486 would be called the DX3. **But noooo.** The company named it the DX4! When I asked the company about this, it had no explanation. In fact, there is an explanation that Intel will not reveal. It's part of a long-term legal strategy to make Intel's chip names and numbers **proprietary**.

In an earlier court case with AMD, Intel tried to convince a judge that the 086, 186, 286, 386, and 486 chips shared no common naming convention. The company wanted to sell the idea that these chip numbers were all a **coincidence**. It was just a fluke of nature that the sequence was 0-1-2-3-4. The same argument was made for the DX and SX chips when the company denied that *DX* referred to double precision (32-bit) and *SX* referred to single precision (16-bit). The DX and SX monikers, said Intel, were just added as meaningless proprietary names. Now this was all very funny to anyone who listened to this nonsense. But Intel desperately needed some way of **not allowing** its chip names to fall into the **public domain**. So the latest strategy is to get silly with the names. The 486SX had nothing in common with the 386SX. The 486SX wasn't a 16-bit chip; it was a chip with no math coprocessor! There would be no 586; there would be the Pentium. Now this! The DX4. The big loser in all this is the confused user. It's also **misleading** to use the DX4 moniker. It implies that the chip is clock-quadrupled—which it is not.

Intel likes to make the argument that many of the clone chips did not have the same capabilities as the Intel 486. This argument was well received, and it got many users to go with Intel because a one-to-one comparison could be made. Combining this with the **powerful Intel Inside** ad campaign was working. But now, every chip from every vendor is named something different, and users can no longer make a direct comparison. All sorts of odd assertions can be made if just one **screwball** function is added to a clone chip. I can see the advertisement now: "Does Intel have the Sponge Command? No!! It's found only in the AMD 986DX10!"

How a Bureaucrat Thinks Dept.: Here's a classic. I'm listening to an IBM executive talk about the future of operating systems, and he tells the story about how our esteemed editor-in-chief, Michael Miller, has made a fuss over this fellow's use of the **dopey term**

*Intel is finally shipping
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Intel won't reveal.*

Classic Applications. This term refers to old DOS apps like WordStar. The guy says Miller had a good point and was about to discard it from his lexicon. That's when he realized that the term was too broad-based, and after all, not all old applications were true classics. So he decided to adopt a new term, **Heritage Applications**, to refer to old, crappy DOS apps. The term *Classic Applications* would apply only to true classics.

So I'm thinking to myself, "Sheesh, here's an IBMer about to do the right thing and get rid of unnecessary jargon but instead coins an **additional unneeded term!**" To top it off, he thinks he did the right thing by further complicating matters. Ironically, this fellow is one

of the smarter guys in the company. It's wacky. It's nuts. It's IBM. (Anyway, I find this stuff amusing.)

Correction Dept.: The February 8, 1994, Inside Track listed the wrong phone number for the National Technology Transfer Center in Wheeling, West Virginia, a clearinghouse of information on 700 federally funded technology labs. I still say this is **hot info** you should get your hands on, and you'll have better luck if you dial 800-678-6882. Please excuse the mistake.

Genuinely Interesting Software Dept.: It's hard to imagine a product better thought out than Auction! It enables real-time management of auctions and keeps databases of participants, items for sale, winning bidders, and other auction necessities. It maintains mailing lists, develops auction reports and pamphlets, makes bid sheets, and prints invoices. **A killer product, and it's \$49.95!** Contact Auction Systems (415-286-1141; fax, 415-574-2615). **Highly recommended.**

Smart Money Dept.: The Database of the Month comes from Digital Directory (6931 Arlington Rd., #405, Bethesda, MD 20814; 617-639-2900; fax, 617-639-2980). Here it is, folks. These are the people making the CD-ROMs with **all the phone numbers in the country**. It also includes a **reverse directory**, so you can look up an address or a phone number and see whom it belongs to. The plain (no reverse capability) two-disk directory of 80 million households is just \$83. The business directory of 9.5 million businesses also sells for \$83. If nothing else, **you must buy this business-directory disk**. I also recommend the five-disk reverse directory of 90 million businesses and households. This remarkable effort sells for \$249. Information overload, here we come. These disks are updated quarterly, so the information is as good as it gets. This is one of the few CD-ROM sets that I keep on my desk. □



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Jim Seymour

On-Line Ties That Bind

Sometimes words fail. Evolved within familiar paradigms, perfectly satisfactory when used to describe behavior within those familiar, comfortable walls, words stutter and stumble and fail when we drag them into areas of human experience that did not

exist when those words were coined. They are failing me now.

I miss David Alsberg. It is as simple as that, but that does not say nearly enough. I really liked David; but that is not enough either. You see, I never met David, in the conventional sense. Yet we argued, agreed, laughed, and scorned others as if we worked at adjoining cubicles or were back-fence neighbors. We knew each other only in that world the media loves to call cyberspace, the community of people who hold out their ideas, their enthusiasms, their hopes, their fears, and ultimately themselves for others to see on the on-line services popular with many PC users.

David was a regular on ZiffNet, the Ziff-Davis-sponsored service within CompuServe. He was a constant presence in the PC Magazine Editorial Forum on ZiffNet, where he participated in endless debates and discussions. A former IS professional at New York's Citibank, he was knowledgeable and voluble about computer issues, but he was also interested in and engaged by social issues.

He told funny stories, made his points through Socratic questioning, argued passionately for things he believed important, and sometimes rebuked—more often with the satirist's lance rather than the flamethrower preferred by many on-line denizens—those who said dumb things.

David stretched my thinking, made me laugh, made my blood boil. I learned about other ZiffNet regulars from the way he drew them out.

And I miss him.

I miss David because on Tuesday, December 28, 1993, he was shot to death, the ultimate innocent bystander in a murder that has become for many of us involved with ZiffNet the

cruelest memory of the violence around us. On that Tuesday, three days after Christmas, he was standing at a magazine rack in a ground-floor store in New York City. Suddenly an 18-year-old who had just held up an upstairs business raced through the store where David was standing, firing shots from a 9-mm pistol at his pursuers.

David was, in the words of a detective from the 114th Precinct, "absolutely in the wrong place at the wrong time—an innocent bystander who never knew what hit him."

David, 42, left a wife, Betty, and a two-and-a-half-year-old son, Mark.

Ironies abound. David was a board member of Police and Community Together, a group working to reduce crime in his Astoria neighborhood. Sandi Galanakis, who chairs the group, recalls David's hard work and contributions: "He was a really brilliant man. He cared about his community. Despite the long hours he worked on his job, he took the time to attend our meetings, give advice, help out with our civilian patrol."

More: At the time he was killed, David was immersed in a long on-line discussion about gun control.



It's amazing how powerful on-line friendships can become, even if you never meet face to face.

ON-LINE FAMILY

In the weeks since David's death, I have thought a lot about how we can come to feel close to someone we have never met in the literal sense.

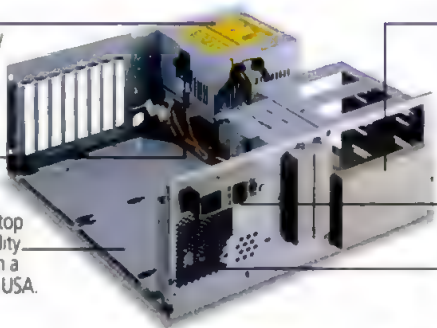
You could argue that feeling close to someone we have corresponded with on-line is no different than feeling close to a pen pal. But there is a difference, a big one: Pen pals exchange private messages. They may become close, but it is not that deep closeness that grows from holding yourself out to other people in public.

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Jim Seymour

Whatever you may think of the notion of on-line communities, you should know that it takes courage for people to reveal themselves before the thousands of people who in effect listen in, following these on-line colloquies without adding their own comments. Especially in a contentious on-line forum, with participants forced to stand and defend their assertions, it takes courage to stay the course.

David had that kind of courage.

I also find interesting the outpouring of grief from others who knew David only as I did, through his on-line presence. Long message threads spun off on ZiffNet as word spread—on-line, of course—of this tragedy. Hardly any of those who shared their sense of loss in that on-line wake had met David face to face, yet they felt that same sharp stab I felt when I learned of his death.

Those who scoff at the notion of electronic community sometimes suggest that it is inhabited by classic Lonely Guys, get-a-life types. David gave the lie to that: He had a vital, engaged life with his real family and community, as well as this second, on-line family, a community of similar vigor. Those two worlds almost never intersected; yet David lived, literally, in both.

I find it interesting, and a little discomfiting, that those of us who were part of his second, extended family came to know his real family only after—and only because—he ceased to be a presence among us on ZiffNet. While we must never confuse the real and the virtual communities in which we live, we need not isolate one from the other: Both are populated by real, living, breathing people who share important bonds.

For many of us who live and play part of the time in the etherworld, David Alsberg will long remain present at the table, at once reminding us of the curious intimacy of these virtual worlds and of the terrible fragility of the real world.

Though he had been doing some consulting work, David had lost his job at Citibank in a cutback and was out of work, with no benefits for his survivors, when the shooting occurred. A fund has been established to help his wife and son. If you'd like to help, contact The David Alsberg Trust Fund, c/o James O'Gara at Kelley Drye & Warren, attorneys-at-law, 101 Park Ave., New York, NY 10178. □

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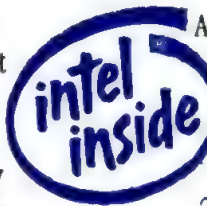
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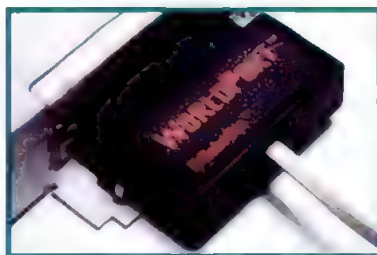


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CIRCLE 920 ON READER SERVICE CARD



Bill Howard

Grab These Gadgets

Most people deeply involved with PCs for a few years develop short lists of favorite products that help them do their jobs faster, better, or smarter. Here are about a half-dozen products I've seen and used recently that I'm especially keen on.

CD-ROM changer. CDs are like peanuts: You can't have just one. So isn't it silly that in 1994 you're constantly swapping disks, just as you were ten years ago before your PC had a hard disk? If you use a lot of CDs, check out Pioneer's six-disk CD changer, the DRM-604X. Not only is it incredibly convenient, it's also the fastest CD-ROM drive we've ever tested: quadruple-speed. Switching among disks in the magazine (the same magazine you find on Pioneer's audio CD players) takes 10 to 15 seconds. With a recent price cut, it sells for about \$1,000. A just-shipped, double-speed, 6-disk changer, Pioneer's DRM-602X, sells for less than \$700, or about the price of two single-disk CD-ROM drives. For CD-ROM fanatics, there's also an 18-disk unit, the DRM-1804X, that will set you back about \$2,000.

Affordable color printing. Out since last fall, the Canon Bubble Jet Printer BJC-600 offers amazing value: a street price of less than \$600 for a high-quality, high-resolution, color ink jet printer that won't break you when you're printing black-and-white text. A product like this can lead to a round of departmental one-upmanship: When everybody else passes around laser-printed charts in the meeting and you pull out laserlike color charts, your colleagues will be looking for their own color printers. A page costs about 15 cents for color and 3 cents for black (all-text) because each of the four ink cartridges is separate, unlike the design of many other low-cost color printers. While the BJC-600 is the best sub-\$600 color printer now, based on pre-production samples the new HP DeskJet 560C (\$719 list) should be in the same league in price, speed, and quality.

Better mice. To me, the resisting friction of the mouse cord is a minor though constant annoyance.

Logitech hit on a truly smart solution with its MouseMan Cordless. It has an embedded radio transmitter and a receiver that connects to your PC. With about a \$90 street price, it's only a few dollars more than a premium corded mouse. If you want to alleviate tension on a corded mouse, consider Mousetamer, a \$4.95, 6-inch-high, spring-on-a-base accessory from American Business Concepts (214-380-4422). The mouse cord clips to the top of an antenna-like spring, which bends and feeds you more cord when you drag the mouse. Tape a dozen pennies inside the hollow base to keep it from tipping over.

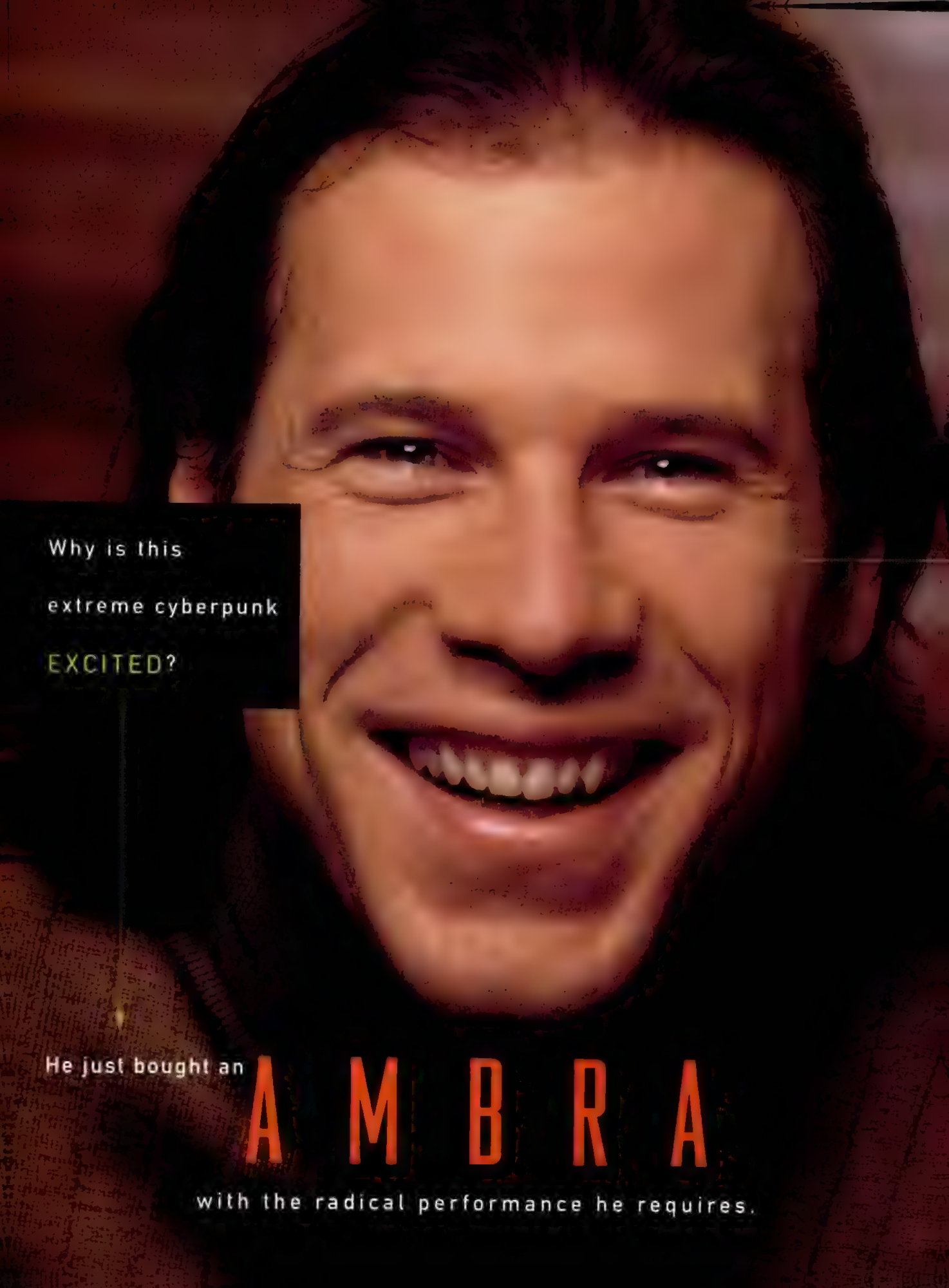
Better mice for kids. Small hands deserve small mice; the huge Microsoft dogleg mouse is especially inappropriate for kids. The Logitech Kidz Mouse is cute (molded in the shape of a live mouse), cheap (about \$40 on the street), and accurate. If you and the kids share one PC, you can attach an adult mouse simultaneously.

Printer sharing. Want to print from your laptop when you're in the office? Either you save the laptop file to a floppy disk, transfer it to your desktop PC, and print from there, or you burrow in the dust balls behind your PC and borrow the printer cable. What a waste of time either way!

Instead, invest a few dollars in a printer-sharing device. A manual A/B switch box plus extra printer cables will do the trick for less than \$100, although printer vendors prefer that you use an electronic switching device. The neatest such tool I've seen is SmartPrint, from Dresselhaus Computer Products (909-945-5600). A series of modules—one per PC or printer—lets you print from many PCs to one printer, one PC to many printers, or many to many, depending on how many modules you buy. It costs \$199 for a two-PC, one-printer configuration. □



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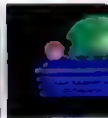
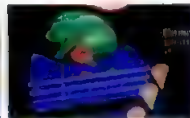
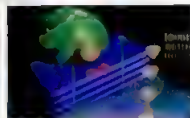
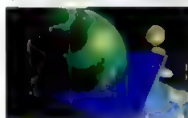
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- 5 drive bays
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- 32-bit local bus graphics
accelerator, 1MB
- 15" FST-NI color monitor, LR
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- 2X CD-ROM drive
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SUBNOTEBOOKS

SMALL Wonders

Between the worlds of high-powered notebooks and minimalist electronic organizers is a world of subnotebooks. *PC Magazine* tests 10 of the newest systems built for the road.

By Christopher Barr

There is no escaping the fact that we live in a world of extremes. Even the world of portable computers has two accepted formats with little middle ground: Notebook PCs are powerful but can be a heavy load to carry; electronic organizers are fine for keeping track of phone numbers and writing the occasional short note but can hardly be considered full-fledged computers. Between the powerful notebook and the convenient organizer sits an ultraportable computer that lets you have the best of both worlds: It's called the subnotebook.

What separates a subnotebook from a notebook? Two pounds, two inches, and until recently, too many tradeoffs. Today's subnotebooks are not simply shrunk notebooks or pumped-up organizers; they are portable PCs with at least minimal computing power, at the size of a Day Runner or Filofax. In the course of our examination of this quickly changing market, we were continually comparing these small wonders to the old standby—pencil and paper. While paper is lighter, does not require any start-up

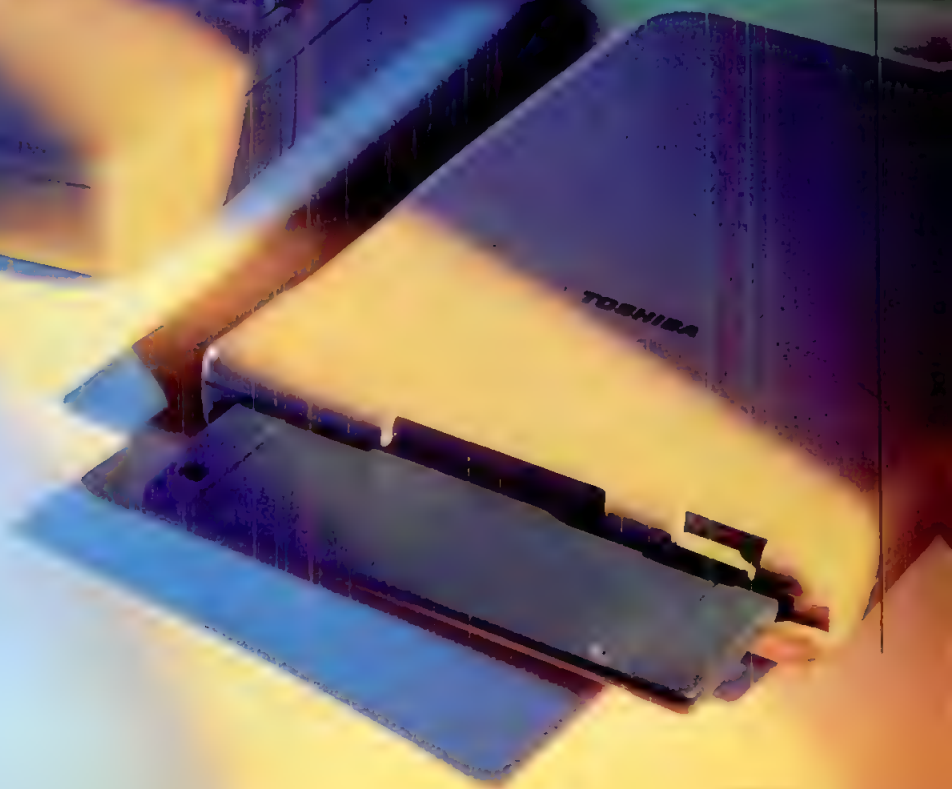
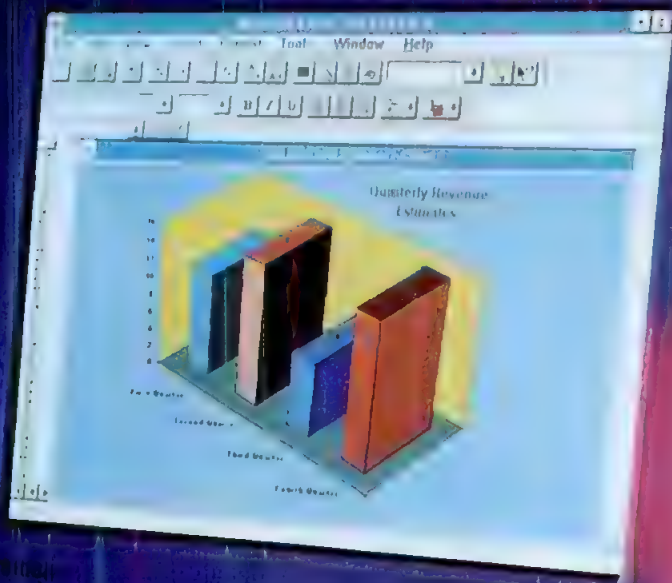
time, and never runs out of battery power or suffers a general protection fault, written data can't be electronically searched. Nor can it tell you the time, send a fax, access e-mail, or manipulate a spreadsheet.

Lightweight, portable computing has been pursued by several technological pioneers. While underpowered and heavy by today's standards, the venerable Toshiba T1100, introduced in 1987, is still carried by journalists around the world. In 1988, NEC introduced a 4-pound UltraLite that came sans floppy disk drive and used lithium batteries. In 1992, two 4-pounders were introduced: Dell's 386-powered

320SLi and Gateway's first HandBook, which ran on a 286-class processor. But pioneers blazing a trail face more dangers than those who hold back until the technological path has been cleared. The subnotebook didn't at first impress the computer-buying public, because of design shortcomings—some of which continue today—such as shrunk keyboards that are

IN THIS STORY

Altimia Traveler
Aspen Starlite
Epson ActionNote 4000
Gateway HandBook 486SX-25
HP OmniBook 425 Superportable PC
IBM ThinkPad 500
Packard Bell Diplomat 170M Subnotebook
Toshiba Portégé T3400CT
Twinhead SubNote 4DX/33M
ZDS Z-Lite 425L Model 170W



difficult to type on, hard-to-read screens, and pointing devices that aren't as comfortable to use as a desktop-PC mouse.

These systems are not desktop replacements by any stretch of the imagination. Indeed, we think that many buyers of subnotebooks generally are the users of three different classes of PCs: a desktop at home or work, a full-size notebook, and a diminutive subnotebook. More than anything else, subnotebooks offer the convenience of being able to carry a PC without taxing the seams of a briefcase.

Subnotebooks achieve their small sizes by incorporating the latest in low-power LCD panels and high-tech batteries, and by leaving as much at home as possible. Internal floppy disk drives are reengineered into 1-pound standalone units. All can run Windows to varying degrees of success, and all have pointing devices—some are wonderful, some are not. Each has, at minimum, one Type II PCMCIA socket that can be used for credit card-size peripherals such as modems or network adapters.

REVIEW CRITERIA

To be included in this issue's roundup, vendors had to send us 486-class subnotebooks that weigh 6 pounds or less including battery, cables, external floppy disk drive, and power adapter. We received ten systems that met these criteria. The base systems, without counting the power supply, cables, and external

floppy disk drive, weigh from an admirably light 2.9 pounds (the HP OmniBook 425 Superportable PC) to 4.4 pounds (the Toshiba Portégé T3400CT); the Aspen Starlite, Epson ActionNote 4000, and IBM ThinkPad 500 fall somewhere in between. There are several pairs of near-identical twins, as well—though they may not share all the same components: the Packard-Bell Diplomat 170M Subnotebook and ZDS Z-Lite 425L Model 170W, the Altima Traveler and Twinhead SubNote 4DX/33M, and the Aspen Starlite and Epson ActionNote 4000.

We give special treatment in accompanying sidebars to two systems of merit that didn't quite meet our criteria: The Panasonic CF-1000A includes an internal floppy disk drive while weighing just 6 pounds. And the Olivetti Quaderno 33 is every bit as small as the rest but uses a 386-class CPU.

A few systems arrived too late to be included in this roundup. One was the Micronote Lite 4010F from Mitac US (510-656-3333).

Another was the Ambra SN425 (800-252-6272), which weighs 4 pounds and starts at \$1,498. The Compaq Contura Aero 425 monochrome subnotebook, introduced after this story went to press, weighs only 3.5 pounds and costs less than \$1,500. It will be followed shortly by a color version.

But the best may be yet to come. Later this year, AST Research will unveil a 3-pound subnotebook that contains the latest wireless communication technology, including built-in e-

mail and fax applications. Designed for the roving executive who is mostly interested in keeping in touch, it will use Arabesque's Ecco Simplicity Personal Information Manager (PIM) as its user interface. The system will likely keep a

RECENT REVIEWS

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January 25, 1994page 110

Eleven Pentium PCs go head to head, setting new *PC Magazine* benchmark test highs as they compete for the top spot.

- **Color Goes Mainstream**
December 21, 1993page 191

PC Magazine looks at 33 of the newest affordable color notebooks that can open the world of color to the frequent traveler.

- **The Portable Puzzle**
August, 1993page 125

PC Magazine reviews 68 color and monochrome 486 notebook PCs and takes a look at PCMCIA technology.

HIGHLIGHTS

Subnotebooks

drives. Since size and weight are reduced, you can easily put any subnotebook into your briefcase without stretching the seams.

CACHE MATTERS. Systems with more internal processor cache, such as those with an IBM 486SLC CPU (16K cache) or Intel CPU (8K cache), excelled on our processor benchmark tests. Those with the least cache—powered by the Cyrix or Texas Instruments 486SLC chip using 1K of internal cache—lagged in terms of processor performance.

SCREEN TYPES varied widely. The Toshiba Portégé T3400CT's 7.8-inch active-matrix display is the best of the bunch, while the Gateway HandBook 486SX-25's oddly shaped screen and the nonbacklit HP OmniBook 425 Superportable PC's screen are the hardest on the eyes.

TOSHIBA'S PORTÉGÉ gives you a new type of battery—lithium ion—which allows the unit to run for about 4 hours on a single charge. Lithium-ion batteries can hold about one-third more power than nickel hydride batteries.

IS A STANDARD NOTEBOOK PC too much? Is an electronic organizer or Personal Digital Assistant too little? Today's state-of-the-art subnotebooks, which combine the organizer's convenience with the notebook's power, may be just right. The result of computer miniaturization taken to its extreme, these systems weigh less than 6 pounds including all external devices.

RAPIDLY EVOLVING, subnotebooks incorporate a smaller battery, screen, and keyboard than a full-fledged notebook and use external floppy disk



EDITORS' CHOICE

• **Toshiba Portégé T3400CT**

universal phone book used by all applications and may incorporate a "sideswipe" PCMCIA modem that eliminates the cumbersome connection dongle by passing the signal to a built-in RJ-11 phone plug. In addition, the Mac world has a recent arrival—the PowerBook Duo 270c—that combines an active-matrix color screen with 4 hours of battery operation in a small package. At \$3,099, this machine also adds a powerful and convenient docking station that pulls the system in, much like a VCR sucking in a tape.

As usual, we retained our emphasis on a combination of DOS and Windows applications; we set our system memory requirement at 4MB of RAM but recommended 8MB—a more appropriate level for Windows operation. Because there is more in common among these systems than there is different, we have broken with our normal practice of presenting evaluations in individual reviews and instead compare the systems in one breath. For more complete information about each individual system, consult the fact files (arranged alphabetically) and the features table.

STRENGTHS AND WEAKNESSES

The price to pay for small size is often a big one. At \$3,999, the Toshiba Portégé—the only color system in this review—costs as much as an inexpensive Pentium desktop system. For the thrifty, there is also a monochrome version—the Toshiba Portégé T3400, which costs \$2,599 and weighs 4.1 pounds. At \$1,814, the Gateway HandBook 486SX-25 is the least expensive of the group.

A battery of benchmark tests exposed the strengths and Achilles Heels of each subnotebook. Even though all the subnotebooks are powered by 486 processors—including new low-power 3.3-volt CPUs from Intel and Texas Instruments—performance was not strictly determined by CPU clock speed. The range in processing ability was enormous—tenfold. Yet performance was often influenced by memory subsystem, design, and the capabilities of installed components.

If you run mostly Windows applications, consider the 8MB, 25-MHz Altima Traveler, which outperformed the other

Every once in a while a product comes along that appears to be such a radical departure from accepted wisdom and adds so much to the state of the art that it redefines its category. The Toshiba Portégé T3400CT subnotebook is one such product.

The 4.4-pound Portégé packs a lot of power, functionality, and usability into a diminutive form. This unit's 7.8-inch active-matrix color screen is the first VGA color display in a subnotebook format, and the screen's miniscule 3.3-watt power drain and ability to render rich, bright colors will likely not be rivaled by any other machine anytime soon. This machine, which is equipped with a low-voltage (3.3 volts) Intel 486SX/33 processor, a Type II PCMCIA expansion slot, and a 126MB hard disk, doesn't skimp on computing power, storage space, expandability, or functionality. The Toshiba Portégé T3400CT is nothing short of the closest thing we have seen thus far to a full-fledged notebook in a subnotebook format.

While this combination of active-matrix color display, high-capacity hard disk, and high-end performance would—on paper—seem to add up to a disappointingly short battery life, the Portégé was able to run on our battery tests for more than 4 hours on a single charge. This is partly due to this unit's

aggressive power management scheme, revolutionary lithium-ion battery pack, and its low-voltage processor. Originally used in cellular phones and video cameras, lithium-ion cells pack approximately one-third more power per pound than conventional nickel hydride batteries, which makes them perfect for either extending a subnotebook's battery life or saving precious real estate inside the case—or both.

HONORABLE MENTION

Hot on the tail of Toshiba's Portégé were three subnotebooks of distinction: the IBM ThinkPad 500 and two clone cousins—the ZDS Z-Lite 425L Model 170W and the Packard Bell Diplomat 170M Subnotebook. While the supply of the IBM ThinkPad 500 was disrupted due to a redesign of its batteries, it is still managing to turn many heads as a full-function and powerful subnotebook. The Zenith and Packard Bell subnotebooks excel in the field of integration, making them portable computers that are easy on the eye.

units on our Winstone application test with a score of 17.8. The 4MB, 33-MHz Toshiba Portégé came in a close second with a score of 16. With the exception of the Epson ActionNote and Gateway HandBook, the remainder of the systems settled in with scores close to 10. For a more detailed analysis, see "What the Numbers Mean" in the benchmark test sidebar. If you require the fastest graphics performance, you might consider the Aspen Starlite, which turned in the highest Graphics WinMark score.

DOS applications are more processor

dependent. The subnotebooks we tested had CPUs from Cyrix, IBM, Intel, and Texas Instruments. A key difference among them is the amount of on-board cache: The Cyrix and TI 486SLC chips have 1K, the Intel chips have 8K, and the IBM chip has 16K. The subnotebooks that use an Intel processor—the Altima Traveler, Gateway HandBook, Packard Bell Diplomat, Toshiba Portégé, Twinhead SubNote, and ZDS Z-Lite—produced top DOS scores, as did the IBM ThinkPad, whose chip contains the most internal cache. The subnotebooks that use

the Cyrix and TI chips turned in the four lowest DOSmark and processor scores.

The top DOSmark score went to the Toshiba Portégé, with the IBM ThinkPad and Twinhead SubNote right behind. These three subnotebooks turned in the highest processor scores as well.

LIGHT, LIGHTER, LIGHTEST

When it comes to carrying weight, the HP OmniBook and the Gateway HandBook are the featherweights of this class. The HP OmniBook is 2.9 pounds and the HandBook is 3.0 pounds, including their batteries. But both achieve that weight by using the smallest-capacity hard disks of this group (43MB in the HP OmniBook, and 82MB in the Gateway HandBook), and by using LCD panels that can be difficult to read at times. The other

machines average about 4 pounds.

It is instructive to look at two design extremes: those of the HP OmniBook and Toshiba Portégé. The HP OmniBook is an application-specific subnotebook, which comes with Microsoft Word for Windows and Excel, and it's targeted for users of those programs. It also comes with four Type II PCMCIA sockets, which are used for drives and peripherals, and it has an internal modem slot.

Unlike any other, the HP OmniBook has DOS and Windows stored on a PCMCIA ROM card (read-only memory), which is the system's D: drive. Applications can be loaded on a 42MB Type III PCMCIA hard disk (the system's C: drive). Because it takes the equivalent of two Type II slots, that leaves one free PCMCIA socket that can be used for a

modem, LAN card, or the 10MB flash memory card we used.

While more than three times as expensive as magnetic storage, this semiconductor-based memory does not require electricity to keep the disk spinning; power is required only to read and write data. And because operation is all-electronic, power use is minimal. As a result, a subnotebook can last about twice as long on batteries when using flash-memory storage. An added bonus is that there are no moving parts, so flash memory is virtually silent.

Since the operating system is stored in ROM, the HP OmniBook gives instant-on performance. It has hot keys designed to bring up the two Microsoft applications, as well as a number of utilities, and a PIM. What's more, the HP OmniBook

■ The Sum of the Parts: *The Components of a ZDS Z-Lite*

While the sum of the parts always equals the whole, in the case of subnotebooks, the smaller the whole the better. The ZDS Z-lite line succeeds in packaging all the necessary parts into an attractive whole. The Z-Lite's system weight is 4.1 pounds; the total

travel weight—which includes the external floppy disk drive, AC adapter, and power cord—is 6 pounds. Not surprisingly, the display is the largest contributor to the total weight—24 percent. The battery is the second-largest contributor: It takes up

15 percent; and the AC adapter takes up 9.3 percent. What is surprising is that the Seagate hard disk weighs little more than an average power cord and weighs the same amount as the casing that surrounds the external floppy disk drive.—William P. Flanagan



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Price/Performance Index: Subnotebooks

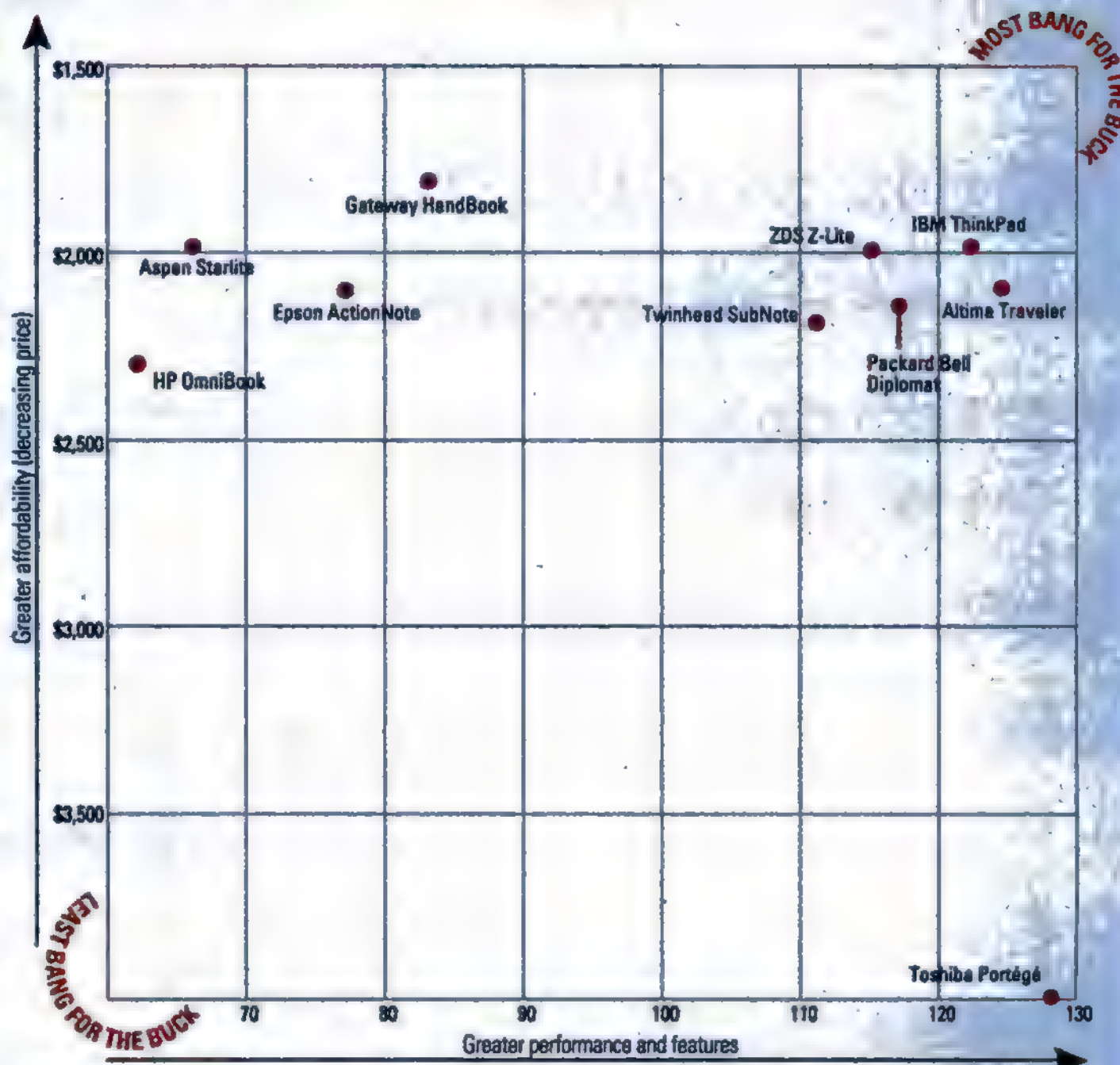
The IBM ThinkPad 500 offers the best bang for the buck in this roundup. Its price of \$1,999 is the third lowest of all tested units, and its performance proved it to be among the most powerful of the ten subnotebooks we tested.

There are two standouts in this roundup that offer exceptional price or exceptional performance—but not both. The Gateway HandBook 486SX-25 costs \$1,814, almost \$200 less than the next most expensive system. But what you get for that price is a system that placed last on three of our benchmark tests and was a mediocre performer on the rest. The Toshiba Portégé T3400CT placed in the top five on all tests, and it sports an active-matrix color display. But it carries a hefty price of \$3,999. With the exception of the Portégé, however, the products in this roundup are closely priced—within a \$500 range.

At the low end of the performance and features scale is the HP OmniBook 425 Superportable PC. This unit placed near or at the bottom of the heap on all of our benchmark tests; its price of \$2,304 is second only to the Portégé. Keep in mind, however, that a stripped-down version of this unit carries a street price of around \$1,500.

has an infrared interface that can be used to send files to like machines, similarly equipped desktops, or remote printers. On the downside, the OmniBook operates only in standard mode and was not able to complete our Winstone application test. Hewlett-Packard will upgrade the HP OmniBook line later this year with the 430 model, which will run in Enhanced mode.

The Toshiba Portégé represents the state of the art in shoehorning a full-featured notebook into the size and weight of a subnotebook; it has the power and feel of a system weighing pounds more. Its active-matrix color LCD panel uses 3.3 watts (most active-matrix panels use 5 watts) and its video uses a local-bus design for better performance. The Toshiba Portégé uses Intel's 3.3-volt 33-MHz



THE DATA POINTS

In determining performance scores, we considered benchmark test results (65 percent), travel weight (10 per-

cent), and system features (25 percent). Prices are based on our tested configurations (as listed in each product's fact file).

486SX chip, and it's the only subnotebook to have an optional port replicator—an item that is rapidly becoming standard on notebooks.

BATTERY TIMES UP

In a pound-for-pound comparison to full-size notebooks, the batteries in these subnotebooks ran considerably longer. Much of the improvement in battery life is due to the use of 3.3-volt processors that implement system management mode (SMM), which is used by power-saving software to shut down components and put the processor into a sleep mode.

Nickel hydride batteries are the way to

go. Four of the subnotebooks lasted longer than 4 hours using nickel hydride batteries that weigh nearly a pound each. But the HP OmniBook lasted more than 3.5 hours on a battery that weighs just over 5 ounces. In a battery-life-per-battery-pound comparison, the nonbacklit HP OmniBook lasted more than 10 hours per pound—more than twice as long as the next best. It has the added advantage of being the only subnotebook that can operate on 4 AA lithium batteries in an emergency.

The most promising new battery technology of the year makes its debut in the Toshiba Portégé, which uses lithium ion

Our Contributors: CHRISTOPHER BARR is a senior editor (West Coast) and WILLIAM P. FLANAGAN is a staff writer for *PC Magazine*. TAMI D. PETERSON was the project leader and BRIAN NADEL was the senior associate editor in charge of the story.

Lowest Prices on the SX, DX & *New* DX2-50!

Rave Reviews! Read what the experts say:



"Scoring high in overall value and design, the Micro Electronics WinBook gives you a lot for your money, including an outstanding integral trackball."

PC MAGAZINE, Guide to Portable Computing, 8/93



"If you're a Windows user on a budget, or just have a bad case of Mac envy...you should take a look at the WinBook. It's a machine that can hold its own with more expensive, less thoughtfully designed systems from other direct vendors."

COMPUTER SHOPPER, This Powerbook Twin Acts Like a PC, 9/93



"The WinBook is a great example of what a Windows notebook should be...fast, easy-to-use and a miser on battery life. It's also inexpensive: nearly 50% less than some comparable notebooks."

WINDOWS MAGAZINE, Transcontinental Portable, 9/93

The WinBook Intel486 SX-25, DX-33 & DX2-50 SL Enhanced Features



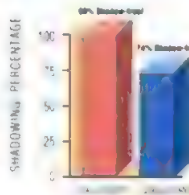
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The WinBook's unique ergonomic features include a sloping wrist rest and keyboard with full-size keys, plus a centered, dual-button trackball—allowing you to work in total comfort away from your desk.

Clear, sharp color display gives you near-active matrix quality at a passive matrix price!

Images are sharper and clearer with less cursor loss. And the WinBook's advanced dual-scan color display gives you 99% shadow-free performance compared to other single-scan passive matrix displays. You get a brighter, crisper, wider angle of view with an 18:1 contrast ratio—compared to

13:1 with previous passive matrix technology



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WinBook



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SX & DX Specifications

- Size/Weight**
 - 11.5" x 8.5" x 1.5"
 - 3.5 lbs. (incl. battery)
- Display**
 - 10.4" color display
 - 10.4" monochrome display
- Processor**
 - Intel 486SX 25MHz
 - Intel 486DX 33MHz
 - Intel 486DX2 50MHz
- Memory**
 - 4MB (expandable to 16MB)
- Storage**
 - 200MB hard drive
- Keyboard**
 - Full-size keyboard
- Mouse**
 - Built-in dual-button trackball
- Ports**
 - Parallel port
 - Serial port
 - PS/2 mouse port
 - VGA port
 - PCMCIA slot
- Other**
 - Fax modem
 - Modem
 - Battery

- Battery**
 - NiMH 2200 MA
- Software**
 - Windows 3.11
 - DOS 5.0

- Processor and Memory**
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Suitability to Task: Subnotebooks

Today's generation of subnotebooks have taken a clear step ahead of their predecessors in striking a good balance between power and portability.

The **road warrior** rating indicates how complete a traveling companion a portable is. An excellent unit combines small size, light travel weight, and long battery life. Other factors include screen size and presence of PCMCIA slots.

The **DOS applications** score reflects a system's ability to run DOS software. Excellent systems are those that earned top DOSmark scores under PC Bench 8.0. The DOSmark formula takes processor

performance, hard disk agility, and DOS-based video functions into account.

Windows applications is a more demanding category; the rating indicates how well a system will operate Windows software. Factors include Graphics WinMark and Disk WinMark benchmark test scores and the score on our new Winstone test. We also take into account a system's hard disk options and the diagonal size of its monitor; with Windows, the bigger the better.

SERVICE AND RELIABILITY

In our 1994 Service & Reliability Survey, we sent questionnaires to 17,000 randomly selected PC

SUITABILITY TO TASK	
Road warrior	FAIR
DOS applications	EXCELLENT
Windows applications	GOOD
VENDOR SERVICE & RELIABILITY	
Reliability	AVERAGE
Repair service	ABOVE AVERAGE
Technical support	BELOW AVERAGE

Magazine subscribers, about half responded. Results are given for vendors for which we received an adequate number of responses. Vendors are rated above average, average, or below average in satisfying computer owners' needs.

Reliability scores indicate whether PC owners felt their systems met their expectations for consistent operation.

Repair service scores are culled from users who contacted the manufacturers to have their PCs repaired.

Technical support scores indicate how well technical support services met respondents' expectations.

storage batteries (LIBS). Previously used only in portable telephones and video cameras, LIBS can be recharged up to 1,200 times—giving them more than twice the cycle life of nickel cadmium or nickel hydride batteries, both of which can be recharged up to 500 times. And since LIBS don't use cadmium, the batteries are less toxic. The big payoff is that LIBS can hold about one-third more power than nickel hydride batteries; the Toshiba Portégé operated for more than four hours on a single charge.

The IBM ThinkPad lasted longer than any other on our battery test, but IBM recalled the sealed lead acid batteries that

came with the test unit. IBM has since started shipping ThinkPad 500s with nickel hydride batteries.

Battery capacity is one thing, but the size and heft of the power adapters are another. The Altima Traveler has the smallest adapter, which is barely the size of a cassette box. The Gateway Handbook's AC adapter, on the other hand, is closer to the size of a small paperback book.

DOZE. . .SLEEP. . .COMA

The beauty of a subnotebook is that you can close it up and return to where you were. All the subnotebooks can go into various power-saving sleep modes—from

a light nap in which the processor remains active to a deep sleep in which the system's memory is written to the hard disk. How efficiently and quickly the system wakes up separates the winners from the losers. Virtually all the systems come with power-conservation features that turn off different parts of the systems at predetermined times. Each unit has a standby mode—although each vendor has its own nomenclature—that acts as a bookmark,

Small, Smaller, Smallest

Functionality and power decrease as you move down the PC ladder. PDAs are convenient, notebooks offer near-desktop performance and functionality, and subnotebooks fill a niche in between.



■ = YES □ = NO

	Notebooks	Subnotebooks	Personal Digital Assistants
System weight, travel weight (pounds)	5-8, 7-10	2-4, 4-6	0.9-2.2, 2-4
Average dimensions (HWD, in inches)	2 x 11 x 8.5	1.5 x 10 x 7.5	1 x 7 x 4
Diagonal (inches)	8.4-10.4	7-9.5	4.8-7.5
Monochrome, passive-matrix color, active-matrix color options	■■■	■■■	■□□
Installable RAM	2MB-32MB	2MB-20MB	640K-8MB
Hard disk capacity	40MB-340MB	40MB-170MB	20MB-40MB*
Floppy disk drive	Internal	External	External**
Main interface	Keyboard	Keyboard	Pen

*This capacity is determined by the current PCMCIA technology

**Not all PDAs require or are compatible with external floppy disk drives



► FACT FILE

Altima Traveler

List price: \$2,147. **Tested configuration:** 8MB RAM, 116MB Toshiba MK-1522FCV IDE hard disk with 128K buffer, 2,400-/9,600-bps data/fax modem, DOS 6.0, Microsoft Windows 3.1. **Options:** 4MB RAM upgrade, \$239; external numeric keypad, \$69; car adapter, \$49; nickel hydride battery, \$129; 14,400-bps data/fax modem, \$399. **In short:** The Altima Traveler packs a lot of power and functionality into its small case. It is a good all-around subnotebook that will satisfy most users

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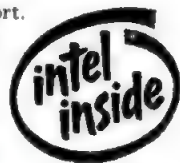
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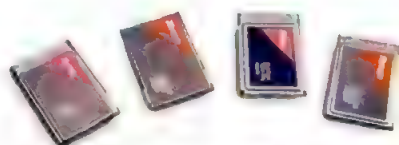
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What the Numbers Mean

While some of the subnotebooks in this roundup performed well on tests of individual components, our Winstone appraisal of overall performance is what counts most. The Altima Traveler and Toshiba Portégé T3400CT are the power systems of this group.

WINSTONE

Those subnotebooks that produced high processor scores were able to use that processing horsepower to excel in Winstone testing. And since the amount of system memory greatly influences the speed of Windows applications as well as a system's Winstone score, one of the two subnotebooks that came with 8MB of RAM, the Altima Traveler (with a 486SL/25 CPU), achieved the highest Winstone score of all the units in this roundup (17.8). Put in a real-world perspective, this level of performance is nearly double that of our standard of reference—a 386DX/25 Compaq desktop machine, which produced a Winstone score of 10. For many of these subnotebooks, adding an extra 4MB of system memory would result in better Windows applications performance.

The Toshiba Portégé—the only color system in this review—did just fine, however, with only 4MB of RAM. Though its processor score tied that of the Twinhead SubNote, the Toshiba Portégé's Winstone score was about 50 percent higher than that of the Twinhead SubNote and was just behind that of the Altima Traveler, which was equipped with 8MB of RAM.

If Windows applications are your mainstay, two systems in this roundup may disappoint you. The slow memory subsystem in the Aspen Starlite caused timing problems that prevented the unit from running the Winstone test; Aspen, however, declined to submit a second unit for evaluation and retest-

ing. The HP OmniBook PC was unable to run in 386 Enhanced mode and therefore could not make use of virtual memory, a requirement for running the Winstone test—and for practical use of Windows as well. The next-generation HP OmniBook 430, which is expected by late spring, will remedy this deficiency.

Other worse-than-average performers on our Winstone applications test included the Cyrix-based Epson ActionNote and the Gateway HandBook, which uses a 25-MHz 486SX processor.

PROCESSOR

Based on processor scores, three subnotebooks in this lineup stood out: the IBM ThinkPad 500 (based on IBM's 486SLC2/50), Toshiba Portégé T3400CT (486DX/33), and Twinhead SubNote 4DX/33M (486SX/33). The Toshiba and Twinhead each achieved an impressive processor score of 20.2; the IBM was hot on their heels, with a processor score of 19.7. This system's SLC2/50 processor uses a 32-bit 50-MHz internal design with a 16-bit 25-MHz data bus, as opposed to the Intel designs, which are based on full 32-bit operation. While the processor core runs at 50 MHz, it transfers data to a system board running 25 MHz.

Four subnotebooks achieved scores that were slightly above average on our processor benchmark tests. The first was the Gateway HandBook 486SX-25, based on the 486SX/25 chip. The remaining three—the Packard Bell Diplomat 170M Subnotebook, ZDS Z-Lite 425L Model 170W, and

Altima Traveler—are based on 486SL/25 chips. Each of these units produced a processor score of roughly 15 or 16.

At the low end of the processor-score spectrum are two units with the same packaging: the Aspen Starlite and Epson ActionNote 4000. But the similarities between these two subnotebooks runs deeper: Both units use the same Award BIOS and Cyrix Cx486SLC/33 processor, and both units eked out processor scores not much higher than 2.5.

The HP OmniBook 425 Super-portable PC, which contains a Texas Instruments version of the 486SLC/25 Cyrix chip, turned in a processor score that more than doubled those achieved by the Aspen and Epson units (the other Cyrix-powered systems). It was still, however, well below average.

VIDEO AND GRAPHICS WINMARK

Since only three brands of video chips are represented among these subnotebooks, it is not surprising that most of the video scores hovered around the group average of 1,457. But one chip stood out as the most efficient with DOS-based applications: the WD RocketCHIP WD24 found in the Toshiba Portégé. The Toshiba Portégé, with its local-bus video controller, produced a video score of 3,537—more than double that of its nearest competitor, the Packard Bell Diplomat.

Even so, the Packard Bell Diplomat, with its C&T 65335 graphics chip, turned in a score that was 11 percent higher than the average. But pay careful attention once again to model numbers; the HP OmniBook and Gateway HandBook used C&T 65510 graphics chips, and their video scores were 34 and 52 percent lower than the average, respectively.

The extremely low Graphics WinMark scores most of these subnotebooks posted were disappointing. Scores ranged from 1.5 to 5.1 million pixels per second. The bottom line is

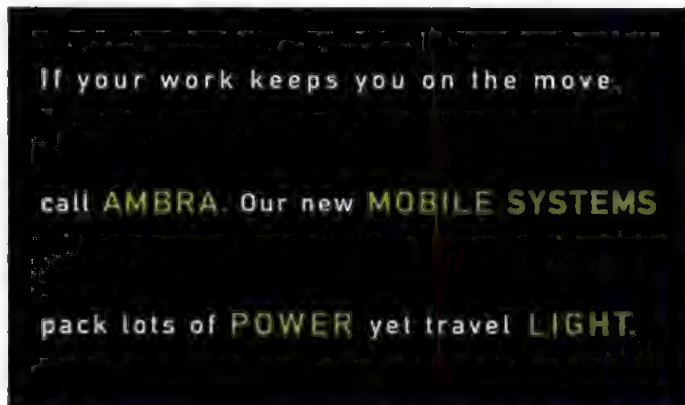
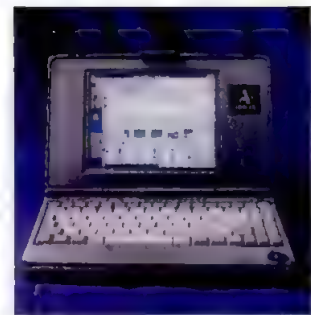
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that you shouldn't expect any of these units to replace your desktop PC.

As usual, some graphics chips performed better than others. On the average, machines using the Cirrus Logic GD-6410 chip performed best: The Epson ActionNote turned in a Graphics WinMark score of 2.3, and the Aspen Starlite (which used a different driver) scored 5.1. Such performance was comparable with that of the IBM ThinkPad, which scored 3.1 using the Western Digital 90C26A graphics chip. The Toshiba Portégé produced a solid Graphics WinMark score of 3.0 using Western Digital's RocketCHIP WD24.

The Packard Bell Diplomat and ZDS Z-Lite, each with a C&T 65335 chip, turned in average Graphics WinMark scores of 2.2 and 2.3, respectively. Their DOS-based video scores, by contrast, were in second and third place (although still way behind the Toshiba Portégé). The poorest Graphics WinMark performers were the Gateway Handbook and HP OmniBook, both posting scores of 1.5; their video scores were also at the bottom of the heap.

DISK AND DISK WINMARK

The ten subnotebooks we reviewed used six different hard disk models, but two brands were primarily used: Toshiba and Seagate. Scores produced by Toshiba hard disks spanned the performance spectrum. The 120MB MK-1522FCV model with a 128K cache showed up in two top-performing subnotebooks: the Twinhead SubNote, which placed first on both the DOS disk and Windows-based Disk WinMark tests, and the Toshiba Portégé, which placed

third on the DOS test. But this hard disk model garnered only an average DOS disk score of 458 for the Altima Traveler.

The only hard disk that performed poorly in this round of testing was the 40MB Western Digital Caviar CU140, which was in the HP OmniBook. Despite being the fastest-rated hard disk, its PCMCIA interface slowed the transfer of data. With a DOS disk score of 174, the HP OmniBook was far outperformed by all other units in this lineup.

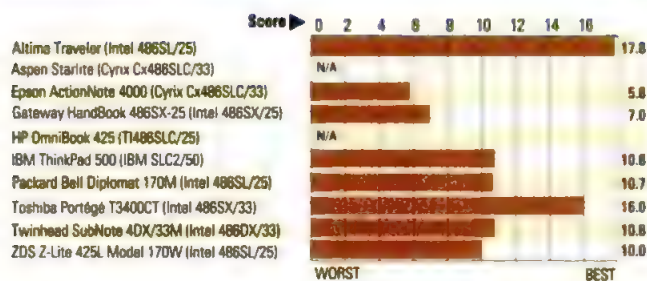
The Disk WinMark scores for the subnotebooks in this roundup closely tracked the PC Bench 8.0 disk scores. The HP OmniBook—with its PCMCIA-based hard disk—again lagged far behind all the other performers.

DOSMARK

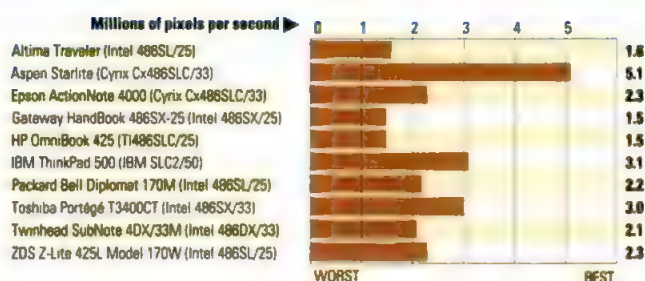
Generally, DOSmark scores are most influenced by processor and disk performance. For example, the Aspen Starlite and Epson ActionNote units netted DOSmark scores below 60—the lowest two in this roundup—because of their low processor scores (both under 3.0) and DOS disk scores (each scored under 400, well below this roundup's average of 475). Similarly, the HP OmniBook wound up with a lower-than-average DOSmark score of 119, thanks to its processor score of 7.7 and its DOS disk score of 174—the lowest disk score of all subnotebooks in this entire roundup.

Not surprisingly, the three systems with the best DOSmark scores were also the systems with the best processor scores: the Toshiba Portégé, Twinhead SubNote, and IBM ThinkPad.

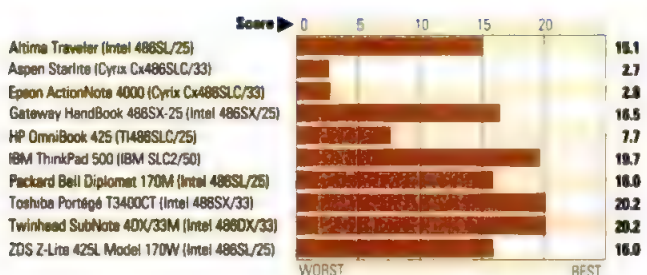
WINSTONE 94



GRAPHICS WINMARK



PROCESSOR



DISK WINMARK



BATTERY LIFE

Most of the units we tested demonstrated a battery life in the neighborhood of 4 hours or better; these tiny machines demand less power than their larger notebook siblings but also pack more power per pound of battery cell. Still, some of these units ran quite a bit longer than others.

One factor that determines battery life is battery type. For instance, the two subnotebooks in this roundup with nickel cadmium batteries—the Aspen Starlite and Epson ActionNote—each ran for less than 2 hours 30 minutes on our Battery Life test. The average life of the six tested units with nickel hydride battery packs was 3 hours 55 minutes. If it weren't for the fact that Gateway's nickel hydride-powered Handbook lasted for only 2 hours 7 minutes, we could make a cut-and-dry statement about these power sources. As it is, we can tell you only that in most cases nickel hydride batteries do outperform nickel cadmium batteries, but for this to occur, good power management schemes must also be in place.

Three subnotebooks demonstrated better-than-average battery lives of about 4 and a half hours: the Altima Traveler, ZDS Z-Lite, Packard Bell Diplomat, and Toshiba Portégé (with a new lithium-ion battery pack). The Twinhead SubNote, which ran for just over 4 hours, was almost as efficient.

When it comes to long-lasting batteries, the leader in this roundup of subnotebooks was the IBM ThinkPad. This unit defied our demanding Battery Life test for 7 hours 36 minutes. This is an impressive time and one that makes this

product—which is already coveted in some circles for its design—a must-have for users who spend many hours computing on the road. IBM did encounter technical problems with this unit's lead acid battery pack, which has been recalled and replaced with nickel hydride cells. IBM claims that the replacement power pack will last about as long as the lead acid battery we used in testing.—*Analysis written by Tami D. Peterson*

How We Tested

In preparing this issue, we used PC Bench 8.0 to test processor, video subsystem, and disk performance using DOS applications. The DOSmark is a summary of those three results and estimates system performance under DOS. We also used WinBench 4.0 to obtain Graphics and Disk WinMark scores, and we used the application-based Winstone 94, Version 1.0, to determine overall system performance under Microsoft Windows 3.1.

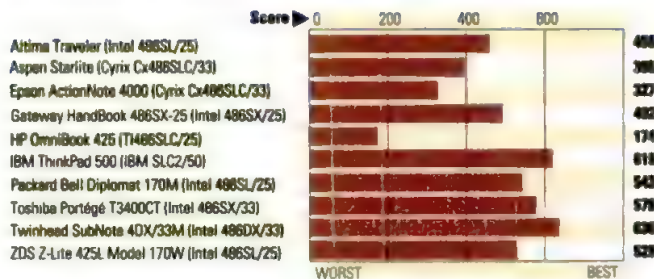
Winstone 94, Version 1.0, measures the time a PC takes to execute a set of application scripts that exercise 12 of the most popular Microsoft Windows 3.1 applications. We normalize Winstone scores relative to a 386DX/25 Compaq Deskpro/M with 4MB of RAM, which has a Winstone score of 10. The Winstone scores let you compare overall system performance under Windows; a system with a Winstone score of 20, for example, performs twice as fast as one with a score of 10; the HiQ P66 Ultra Station achieved the best Winstone score to date—95.

The **processor** score reflects CPU, RAM, and RAM cache performance. It is based on a large instruction mix and either the floating-point coprocessor test or the floating-point

DOSMARK



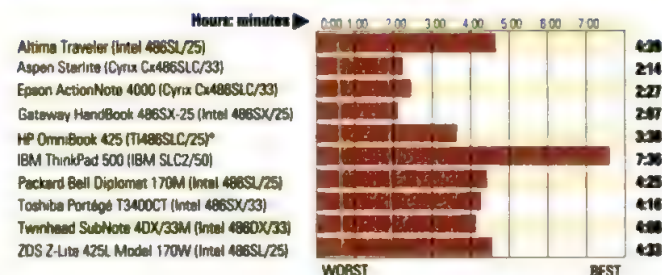
DISK



VIDEO



BATTERY LIFE



* Nonilluminated screen.

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There is one disadvantage to the HandBook 486. As a *PC Week* writer described it: "I almost got mobbed the other day on the train. I was doing what I usually do on the commute: writing on a notebook computer. The only difference was that I was using a Gateway 2000 HandBook 486 ... I can't wait until everyone has one. Then they'll leave mine alone."

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Benchmark Tests: Subnotebooks

ENDS

emulation test, depending on whether the PC has a coprocessor—which could be either integrated with the main processor or located on a separate chip.

The **video score** is a weighted harmonic mean of tests that measure 8- and 16-bit VGA write operations involving both text and graphics.

The **disk score** gauges the performance of a PC's disk subsystem, which includes the hard disk, disk controller, and any hardware or software disk caches. Our tests use more than 100 files in six directories totaling over 30MB. The operations performed include file reads, file writes, file creation, and file deletion.

The **DOSmark** score is a composite rating derived from the processor, video, and disk scores. It indicates a PC's ability to run DOS applications quickly and efficiently.

The **Graphics WinMark** score is a measure of PC graphics performance under Microsoft Windows 3.1. We run 66 different tests—divided into seven graphics test mixes—to evaluate each system's handling of the Windows GDI (Graphics Device Interface). These tests are based on extensive application profiling.

The **Disk WinMark** score reflects disk subsystem performance under Microsoft Windows. The tests use different files and file operations in a blend based on extensive profiling of applications' disk usage.

The **Battery Life** score uses ZDigit, Version 2.0, and is based on profiling of how

users work with their portable PCs. The data has been accumulated over years of testing laptop and notebook battery lives; it provides an indicator of how long a notebook will operate between charges.

To test a subnotebook, we first condition its battery with three consecutive-use cycles of charging and discharging. To provide a level playing field among the competitors, we then set the unit's power management features for optimum performance, regardless of how those features were set at the factory.

To simulate real-world operations, we set the hard disk timeout for 1 minute, the display for 2 minutes, and the standby mode for 3 minutes (or use the closest available setting in each case). We disable the unit's suspend feature. The ZDigit program is set with 2 minutes of active time, 2 minutes of idle time, and 8 minutes of sleep time.

We then test each subnotebook in one of three ways. If a subnotebook has a keyboard port and is able to accept certain keystroke commands, we administer our Undigit test, which periodically sends keyboard commands to wake the system. The second procedure is our Boinker test, which involves a mechanical finger that taps a key on the keyboard, waking the system. It uses the same intervals that our Undigit test uses. Some of the subnotebooks in this roundup have keyboard ports that cannot interpret Undigit's special keystrokes, and we have to test those manually using the Mandigit procedure, where a technician manually strikes keys to wake the system up.

The ZDigit program lets each subnotebook go into its preset sleep mode after a period of inactivity. Then it brings up a Windows application and lets it run for a specified time by injecting the appropriate keystrokes. The state of the screen is constantly monitored, as is the parallel port. The cycle repeats until the battery is depleted and the timer stops.

with the battery sustaining the processor's registers. The Epson ActionNote and Twinhead SubNote will retain the contents for only a few hours; the Toshiba Portégé will stay in suspend mode for about three weeks; the ZDS Z-Lite for two weeks; the Gateway HandBook for a week; the IBM ThinkPad and Packard Bell Diplomat for three days.

The Gateway HandBook, IBM ThinkPad, Toshiba Portégé, Packard Bell Diplomat, and ZDS Z-Lite all enter Standby mode simply by having their lids closed. Open the case, and the unit picks up where you left off, except in the HandBook's case, where you must press a button to resume. The Altima Traveler, Aspen Starlite, Epson ActionNote, and Twinhead SubNote require you to press a key combination to enter and exit suspend mode. The HP OmniBook enters standby when you turn it off and returns to the same screen when you switch it back on.

WHAT YOU SEE

How the user interacts with a computer is based on sight and touch, and the most

critical elements here are the screen and keyboard. If you can't enter and retrieve data or see it on the screen, your subnotebook will be useless.

Without a doubt, the Toshiba Portégé has the best LCD panel of the bunch; the Gateway HandBook and HP OmniBook have the worst. The Toshiba Portégé uses a 7.8-inch active-matrix color LCD panel that can display 256 colors out of a palette of 262,144. It is every bit as bright, rich, and sharp as the panels used on Toshiba's notebooks, only smaller. At the other extreme, the Gateway HandBook's 6.75-by-3.75-inch screen has an aspect ratio (length divided by width) that is longer and narrower than other displays. As a consequence, it gives everything a squashed look. A circle, for instance, looks like an oval, and the rectangular Windows banner looks more like a square. Fonts appear strange but are readable nonetheless.

The HP OmniBook's screen doesn't have that problem because it is quite large and is of the correct aspect ratio. On the other hand, it's the only LCD panel of the



FACT FILE

Aspen Starlite

List price: \$1,990 **Tested configuration:** 8MB RAM, 120MB Toshiba MK-1522FCV IDE hard disk with 128K buffer, PCMCIA 2,400-/9,600-bps data/fax modem, DOS 6.0 **Options:** Ethernet LAN adapter, \$225, Microsoft Windows 3.1, \$50. **In short:** Although the monochrome Aspen Starlite led the group on the Graphics WinMark tests, it lagged behind on all other benchmark tests. This Cyrix-powered subnotebook unfortunately was not able to keep up with its competition.

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- MS-DOS 6.2, Windows for Workgroups 3.11, Microsoft Mouse
- Choice of Lotus Windows application

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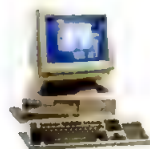


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- DOS, Windows for Workgroups, Mouse



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486DX2-66
\$2195

PACKAGE #3:

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- SVGA color monitor
- DOS, Windows for Workgroups, Mouse
- Choice of Lotus application



486DX-33
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486DX2-66
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- SVGA color monitor
- DOS, Windows for Workgroups, Mouse
- Choice of Lotus application



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- DOS, Windows for Workgroups, Mouse
- Choice of Lotus application



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- 340MB local bus IDE hard drive, 128K cache
- 2X CD-ROM drive, 3.5" floppy drive
- PCI local bus graphics with 1MB RAM
- SVGA color monitor
- DOS, Windows for Workgroups, Mouse
- Choice of Lotus application
- 10-bay vertical case upgrade...\$95



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CIRCLE 155 ON READER SERVICE CARD

bunch that doesn't have backlighting. While the large reflective screen saves battery power, you will have a hard time trying to read it in low light.

All the other units have backlit, passive-matrix monochrome LCD panels. Screen controls for brightness and contrast are sliders or—in the IBM ThinkPad's case—buttons. But the Altima Traveler and Twinhead SubNote use digital controls actuated by pressing a dual-key combination. The Toshiba Portégé has no exterior controls; its brightness is set during setup when you select the power options. Full power will keep the color screen at its brightest; to save power, you can set it to semibright.

DOWN-SIZED KEYS

Full-size notebooks attain their average 8.5- by 11-inch dimensions because of their keyboards. Lilliputian subnotebooks require reduced-size keyboards, and most of the subnotebooks reviewed here have keyboards that are 2 inches smaller than that of a full-size notebook. The exception is the OmniBook, which has the only full-size keyboard of the group.

The IBM ThinkPad has a reduced-size keyboard, but it retains full-size Back-

SUMMARY OF FEATURES

CONTINUES

Subnotebooks

List price (tested configuration) We report the price for the tested configuration of each system. Some PC-system vendors provide an estimated selling price instead of a list price to reflect more accurately what customers should expect to pay for the system.

Dealers/Direct-distribution channel Various machines are sold directly through mail order, through dealers, or through company-owned stores and superstores.

System weight, travel weight The system weight includes the weight of the battery. The travel weight adds that of the AC adapter brick and power cord.

Keys: total, function, cursor The table describes each subnotebook's built-in keyboard: the **total** number of keys, the number of **function** keys, and the number of **cursor** keys.

Type of pointing device installed Each unit had an integrated trackball, a snap-on trackball (which attaches to the system via a special port), an integrated mouse, or a pointing stick (which sits between keys on the keyboard).

The BIOS version (or date) A system's BIOS can affect its benchmark test performance.

System and video shadowing Shadow RAM is a technology that loads system BIOS or video BIOS from slower ROM into faster RAM on boot-up, offering enhanced speed.

Ports for port replicator/docking station A port replicator re-creates the I/O ports. A docking station provides additional ports and space for expansion cards.

PCMCIA slots accept removable credit-card-size I/O devices, such as modems or cards, for expansion memory or for nonvolatile static RAM for storage. There are currently three standard versions: Type I, Type II, and Type III.

Internal modem installed indicates the type of modem sent with the computer. The reviewed subnotebooks included either internal or PCMCIA modems. We list the maximum data and fax communica-

tion speeds; all modems have send and receive capabilities.

Video chip set manufacturer The video chip set affects the maximum external resolution and the number of simultaneous colors an external monitor can display at that resolution. Decreasing the resolution setting usually increases the maximum external colors.

Illuminated screen/Active matrix Systems with illuminated (or backlit) screens are readable even in low-light surroundings. Active-matrix displays are brighter and easier to view at an angle than passive-matrix screens; active-matrix displays provide richer colors as well.

This table includes each system's **rated battery life** as reported by the vendor. PC Magazine Labs independently tests the battery life with power-conservation features enabled, and we report the results (**Battery Life score**) here and in our benchmark test section. We also indicate the battery **charge time while on and off**, as reported by the vendor.

Battery weight, amp/hour rating We report the battery's weight in pounds, as well as how long that battery is rated to deliver a steady current of 1 ampere. You will find a wide range of battery weights and power ratings among the units reviewed in this issue.

The systems in this roundup all include power-conservation features, such as automatic **display dimming** or blanking, automatic **hard disk power-down**, slowing or halting the **CPU**, and **peripherals power-down** for cutting off power to the I/O ports when the machine is not in use. More advanced power management features include **Standby** mode (in which the system preserves its current state in memory, usually via a secondary battery) and **hibernation** (in which the system's state is written to the hard disk, ensuring that the system retains information if battery power fails).

Warranty All units include a one-year parts-and-labor warranty or better.

First-year on-site service charge Some vendors offer on-site service for their subnotebooks. In some cases, service is included as part of the warranty. Some vendors offer free replacement of a subnotebook in lieu of on-site service.



FACT FILE

Epson ActionNote 4000

List price: \$2,108 **Tested configuration:** 4MB RAM, 86MB Toshiba MK-1422FCV IDE hard disk with 32K buffer, 2,400-/9,600-bps PCMCIA data/fax modem, DOS 6.0, Microsoft Windows 3.1 **Options:** 6MB RAM module, \$499; 120MB hard disk, \$270; enhanced AT keyboard, \$69; 10-key numeric keypad, \$89; nickel cadmium battery, \$79; PCMCIA 512K SRAM card. **In short:** The Epson ActionNote 4000 produced midrange performance scores but had a disappointingly short 2-hour battery life.

SUITABILITY TO TASK

Road warrior **GOOD**

DOS applications **POOR**

Windows applications **FAIR**

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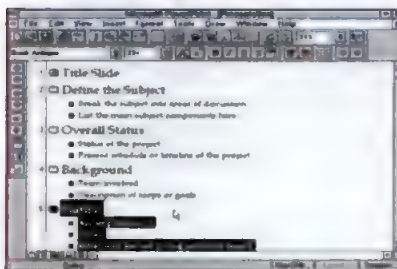
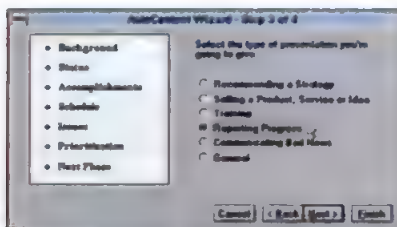
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Microsoft Office

SUMMARY OF FEATURES

Subnotebooks

Products listed in alphabetical order

■ = YES □ = NO

	Altima Traveler	Aspen Starlite	Epson ActionNote 4000	Gateway HandBook 486SX-25	HP OmniBook 425 Superportable PC	IBM ThinkPad 500	Packard Bell Diplomat 170M Subnotebook
List price (tested configuration)	\$2,147	\$1,990	\$2,108	\$1,814	\$2,304	\$1,999	\$2,150 (estimated)
Processor type and speed	Intel 486SL/25	Cyrix Cx486SLC/33	Cyrix Cx486SLC/33	Intel 486SX/25	Ti486SLC/25	IBM 486SLC2	Intel 486SL/25
Hard disk capacity	116MB	120MB	86MB	82MB	43MB	85MB	170MB
Dealers/Direct-distribution channel	■ □	■ ■	■ ■	□ ■	■ □	■ ■	□ □
Dimensions (HWD, in inches)	1.7 x 10 x 7	1.8 x 10 x 7.5	1.8 x 10 x 7.5	1.5 x 9.8 x 6	1.4 x 11.1 x 6.3	1.8 x 10 x 7.2	1.5 x 10 x 7.6
System weight, travel weight (pounds)	4.1, 5.9	3.9, 6	3.9, 6	3, 5.1	2.9, 4.1	4, 6	4.1, 5.8
Display area and diagonal (inches)	4.8 x 6.3 x 7.9	4.5 x 5.9 x 7.5	4.5 x 5.9 x 7.5	3.8 x 6.8 x 7.8	5.1 x 7.4 x 8.9	4.4 x 5.9 x 7.2	5.2 x 6.8 x 8.5
Keys: total, function, cursor	84, 10, 4	79, 10, 4	79, 10, 4	78, 10, 4	85, 12, 4	81, 12, 4	82, 12, 4
Type of pointing device installed	Integrated trackball	Integrated trackball	Integrated trackball	Pointing stick	Integrated mouse	Pointing stick	Snap-on trackball
Motherboard							
Motherboard manufacturer	Twinhead	ETC	Epson	Gateway	HP	IBM	Inventec
Chip set manufacturer	Intel	C&T	ACC	OPTi	VLSI	WD/IBM	C&T
BIOS version (or date)	Phoenix (9/9/93)	Award 4.20	Award 4.20	SystemSoft/ Gateway 1.18	Phoenix 1.1	Phoenix 17.4	Phoenix 4.3D
Setup in ROM/Password in ROM	■ □	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
System and video shadowing	■	■	■	■	□	■	■
Memory and Hard Disks							
Installable RAM	4MB-20MB	4MB-8MB	2MB-8MB	4MB-20MB	2MB-8MB	4MB-12MB	4MB-20MB
User-installable	■	■	■	■	■	■	■
External processor RAM cache	None	None	None	None	None	None	None
Available hard disk sizes	80MB, 116MB	80MB, 120MB	86MB, 120MB, 171MB	82MB, 130MB	43MB, 105MB	85MB, 170MB	170MB
I/O and Expansion							
Parallel, serial, mouse, expansion ports	1, 1, 1, 0	1, 1, 1, 0	1, 1, 1, 0	1, 1, 0, 0	1, 1, 0, 0	1, 1, 0, 0	1, 1, 1, 0
High-speed parallel/serial support	■ □	□ □	□ □	□ □	■ ■	■ ■	■ ■
Ports for port replicator/docking station	□ □	□ □	□ □	□ □	□ □	□ □	□ □
PCMCIA slots	One Type II	One Type II	One Type II	One Type II	Four Type II	One Type II	Two Type II
Internal modem installed	2,400-/9,600-bps data/fax	2,400-/9,600-bps PCMCIA data/fax	2,400-/9,600-bps PCMCIA data/fax	14,400-bps PCMCIA data/fax	2,400-/9,600-bps data/fax	None	14,400-bps PCMCIA data/fax
Video							
Screen manufacturer	Casio	Sharp	Sharp	Sanyo	Hitachi	Info not available	Toshiba
Video chip set manufacturer	Cirrus	Cirrus	Cirrus	C&T	C&T	WD	Intel
Simultaneous external display	■	■	■	■ (via PCMCIA card)	□	■	■
Maximum internal resolution	640 x 480	640 x 480	640 x 480	640 x 480	640 x 480	640 x 480	640 x 480
Maximum internal gray shades/colors	64, N/A	64, N/A	64, N/A	16, N/A	16, N/A	64, N/A	64, N/A
Maximum external resolution	800 x 600	800 x 600	800 x 600	1,024 x 768	N/A	640 x 480	1,024 x 768
Maximum external colors	16	16	16	256	N/A	256	16
Illuminated screen/Active matrix	■ □	■ □	■ □	■ □	□ □	■ □	■ □
AC Adapter and Battery							
AC adapter size (inches)	1.5 x 2.3 x 3.9	1.5 x 2.8 x 5.5	1.5 x 2.8 x 5.5	1.5 x 2.8 x 6.5	1.4 x 2.3 x 4.8	1.5 x 2.4 x 4.9	1.5 x 2.5 x 5.3
Rated battery life (hours)	4	3.5	2.5	3	8	3	3
Battery life score (hours:minutes)	4:39	2:14	2:27	2:07	3:38	7:36	4:25
Charge time while on, off (hours)	8, 2	4, 2	4, 2	2, 2	2, 2	3, 1.5	2, 2
Battery weight, amp/hour rating	15 oz, 0.8Ah	15 oz, 1.3Ah	15 oz, 1.3Ah	8 oz, 1Ah	5 oz, 1.5Ah	16 oz, 2Ah	14 oz, 2Ah
Display and hard disk power-down	■	■	■	■	□	■	■
CPU/peripherals power-down	■ ■	■ ■	■ ■	■ ■	■ □	■ ■	■ ■
Standby/Hibernation	■ ■	■ □	■ □	■ ■	■ □	■ ■	■ ■
Miscellaneous							
DOS, Windows version included	6.0, 3.1	6.0, none	6.0, 3.1	6.0, 3.1	5.0, 3.1	6.1, none	6.0, 3.1
Warranty	1 year	1 year parts, 2 years labor	1 year	1 year	1 year	1 year	1 year
First-year on-site service charge	N/A	N/A	N/A	N/A	N/A	\$40.00	\$129.00
FCC Class B identification number	FKGSBN-4SL	JRUANS-4C33	JRUANS-4C33	JTVHAND486-40	B94F1033	IYL2603	IFO-L486SL

N/A—Not applicable. The product does not have this feature.

C&T—Chips & Technologies Inc.; VLSI—VLSI Technology Inc.; WD—Western Digital Corp.

COVER STORY

Subnotebooks

PC MAGAZINE

EDITOR'S CHOICE

Toshiba Portégé T3400CT	Twinhead SubNote 40X/33M	ZDS Z-Lite 42SL Model 170W
\$3,999	\$2,195	\$1,999
Intel 486SX/33	Intel 486DX/33	Intel 486SL/25
120MB	126MB	170MB
■ □	■ ■	■ ■
18 x 10 x 8	17 x 10 x 7	15 x 10 x 7.6
4.4, 5.8	4.1, 5.9	4.1, 5.8
4.8 x 6.3 x 7.8	4.8 x 6.3 x 7.9	5.2 x 6.8 x 8.5
82, 12, 4	79, 10, 4	82, 12, 4
Integrated trackball	Integrated trackball	Snap-on trackball

Toshiba Toshiba Toshiba T3400CT 0.50	Twinhead OPTi/Twinhead Phoenix (10/7/93)	ZDS Intel ZDS 4 3D
■ ■	■ ■	■ ■
■	■	■
4MB-20MB	4MB-20MB	4MB-20MB
■	■	■
None	None	None
126MB	126MB, 170MB	85MB, 120MB, 170MB

1, 1, 0, 1	1, 1, 1, 0	1, 1, 1, 0
□ □	□ □	■ ■
■ □	□ □	□ □
One Type II	One Type II	Two Type II
None	14,400 bps data/fax	None

DTI	Sharp	Info not available
WD	Cirrus	C&T
■	■	■
640 x 480	640 x 480	640 x 480
N/A, 256	16, N/A	64 N/A
800 x 600	640 x 480	1,024 x 768
256	16	16
■ ■	■ □	■ □

1 x 2.5 x 4.8	1.5 x 2.3 x 3.9	1.5 x 2.5 x 5.3
3	3.5	3
4.16	4.08	4.33
6.2	12.8	8.25
16 oz, 1.4Ah	15 oz, 0.8Ah	14 oz, 2Ah
■	■	■
■ □	■ ■	■ ■
■ □	■ □	■ ■

6.0, 3.1	6.2, 3.1	6.0, 3.1
3 years	1 year	1 year
\$49.95	N/A	\$35.00
CJ6UN827	FKGSBN-486	IFO L486SL

space, Enter, Tab, Caps Lock, and Shift keys; the alphabet keys are slightly smaller than those on a desktop. The keys that got short shrift are the function keys, cursor keys, and the PgUp and PgDn keys. You'll need to pay attention to be accurate when you use them. The Toshiba Portégé has a new keyboard design, with the keys placed near the hinge, and it has a palm rest where the keys would normally be. Although slightly shrunken, the Toshiba Portégé keyboard still has dedicated cursor, PgUp, and PgDn keys.

The Aspen Starlite, Epson ActionNote and Twinhead SubNote have rear-ranged keyboards and relocated Right Shift keys. They also have dual-function arrow keys that double up as PgUp, PgDn, Home, and End keys in combination with another key. The keyboards on the Gateway HandBook, Packard-Bell Diplomat, and ZDS Z-Lite are cramped, but at least the keys are in the expected places.

By the same token, when you're on the road you want a pointing device that does most if not all of what your desktop

mouse can do. Navigating through Windows applications makes this essential. You don't want one that is hard to clip on, one that falls off, or one that gets lost. A subnotebook's small case size makes it a challenge to build in such a device. Of the ten systems in this roundup, most had a trackball of sorts, three had pointing sticks, and one—the HP OmniBook—had a minimouse that pulls out of the case's side.

The Gateway HandBook, IBM ThinkPad, and Toshiba Portégé incorporate variations on the pointing-stick theme. Placement is the key difference: both the IBM ThinkPad and the Toshiba Portégé have their pointing sticks between the G, H, and B keys, while the Gateway HandBook has it on the right side of the case near the Enter key. While your preference is largely a matter of personal choice, the IBM and Toshiba designs allow for ambidextrous operation, which will be liked equally by righties and lefties.

Except for the HP OmniBook, all the others use trackballs. The Packard-Bell Diplomat and ZDS Z-Lite have snap-on versions that attach to the front of the case, adding to its weight and depth. The



▶ FACT FILE

Gateway HandBook 486SX-25

List price: \$1,814. **Tested configuration:** 4MB RAM, 82MB Toshiba MK-1422FCV IDE hard disk with 32K buffer, 14,400-bps PCMCIA data/fax modem, DOS 6.0, Microsoft Windows 3.1. **Options:** 8MB RAM upgrade, \$349; external disk drive, \$99; AC adapter, \$89; nickel hydride battery, \$89; alkaline battery pack, \$29; PCMCIA 2,400/9,600-bps data/fax modem, \$199.

In short: This unit's major shortcoming is a long, narrow screen that tends to distort images.

Gateway 2000 Inc., 800-846-2000, 605-232-2000

449 On reader service card

SUITABILITY TO TASK

Road warrior ■■■■

DOS applications ■■■■

Windows applications ■■■■

VENDOR SERVICE & RELIABILITY

Reliability ■■■■

Repair service ■■■■

Technical support ■■■■



▶ FACT FILE

HP OmniBook 425 Superportable PC

List price: \$2,304. **Tested configuration:** 4MB RAM, 43MB Western Digital Caviar Ultra-Lite 40 PCMCIA hard disk with 32K buffer, 2,400/9,600-bps data/fax modem, DOS 5.0, Microsoft Windows 3.1, Excel 4.0, Word for Windows 2.0. **Options:** 2MB RAM upgrade, \$179; 105MB hard disk, \$669; 40MB hard disk, \$400; fax/modem communications pack, \$379; 10MB flash-disk PCMCIA card, \$600.

In short: A nonbacklit display that is hard to read at times detracts from a machine that is otherwise well designed and engineered.

Hewlett-Packard Co.,
800-443-1254
Fax, 800-333-1917

449 On reader service card

SUITABILITY TO TASK

Road warrior GOOD

DOS applications POOR

Windows applications POOR

Battery Life vs. Portability

The IBM ThinkPad 500 combines a 6-pound travel weight with a battery life of 7 hours 36 minutes. But there is a catch: The unit we tested used lead acid batteries, which were recalled and replaced with nickel hydride cells.

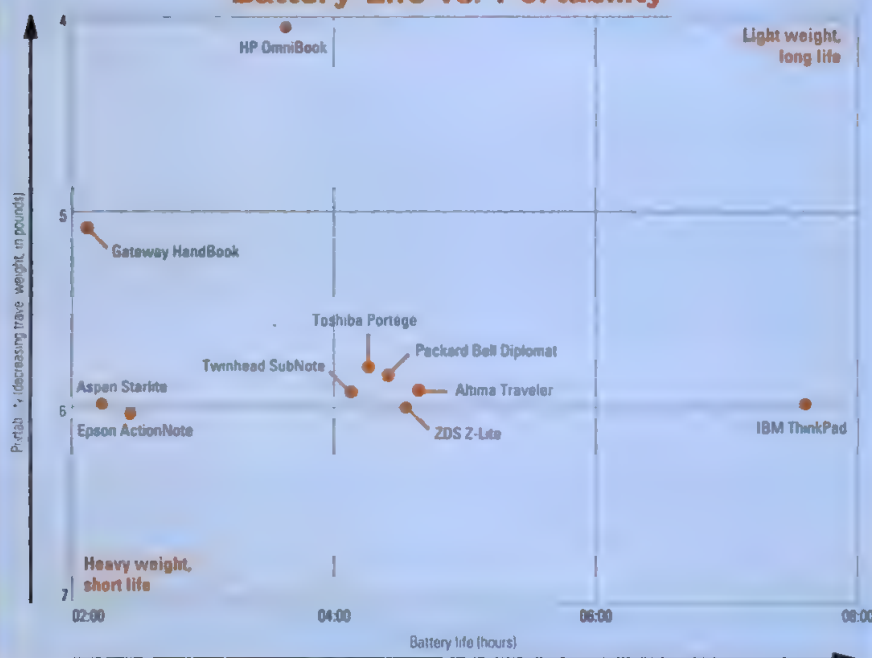
The Altima Traveler, ZDS Z-Lite 425L Model 170W, Packard Bell Diplomat 170M Subnotebook, Toshiba Portégé T3400CT, and Twinhead SubNote 4DX/33M were also outstanding performers. Each checked in with a travel weight of 6 pounds or less and lasted more than 4 hours on

our battery tests. The Portégé's battery ran for 4 hours 16 minutes, and it is the only unit in the roundup with an active-matrix color screen. If travel weight is your biggest concern, the HP OmniBook 425 Superportable PC is the lightest system in the roundup, with a travel weight of 4.1 pounds. But it is the only nonilluminated system in this roundup. While the OmniBook is a compact machine, its battery life of 3 hours 38 minutes is based on the lightest battery of the group.

	Travel weight (pounds)	Battery life (hours: minutes)	Battery weight (pounds)	Battery life per pound (hours: minutes)
Altima Traveler	5.9	4:39	0.94	4:56
Aspen Starlite	6.0	2:14	0.92	2:25
Epson ActionNote 4000	6.0	2:27	0.92	2:39
Gateway HandBook 486SX 25	5.1	2:07	0.53	3:59
HP OmniBook 425 Superportable PC*	4.1	3:38	0.34	10:41
IBM ThinkPad 500	6.0	7:36	0.98	7:45
Packard Bell Diplomat 170M Subnotebook	5.8	4:25	0.90	4:54
Toshiba Portégé T3400CT	5.8	4:16	0.98	4:21
Twinhead SubNote 4DX/33M	5.9	4:08	0.94	4:23
ZDS Z-Lite 425L Model 170W	5.8	4:33	0.90	5:03

* Nonilluminated screen

Battery Life vs. Portability



Altima Traveler, Aspen Starlite, Epson ActionNote, and Twinhead SubNote have small trackballs in the right corner above the keys. Because the case size is so small, the ball in the device itself is small and feels awkward when moved with a thumb. But the tracking is faster than it is with the trackpoint-type devices.

OF CASES AND CABLES

Since subnotebooks are made to be taken on the road, ease of connectivity is paramount. The Altima Traveler and Twinhead SubNote came with an internal modem and a PCMCIA socket, thus giving the user a choice. The HP OmniBook has four Type II PCMCIA sockets and a modem slot. In addition, the HP OmniBook accommodates an infrared interface for connecting to a printer or desktop PC, but it doesn't have a built-in slot to operate an external VGA monitor. If you're considering the OmniBook for making presentations, think again.

All the subnotebooks come with serial and parallel ports; the Altima Traveler, Twinhead SubNote, Aspen Starlite, Epson ActionNote, Packard Bell



FACT FILE

IBM ThinkPad 500

List price: \$1,999 **Tested configuration:** 4MB RAM, 85MB Western Digital AH280 IDE hard disk with 32K buffer, DOS 6.1 **Options:** 2MB RAM upgrade, \$269, 4MB RAM upgrade, \$349, 8MB RAM upgrade, \$649, 170MB hard disk, \$500, extra battery pack, \$49

In short: The IBM ThinkPad 500, which is based on IBM's own clock-doubled SLC2/50 processor, offers both strong performance and exceptionally long battery life

IBM Personal Computer Co., 800-426-2968, 914-766-1900

450 On reader service card

SUITABILITY TO TASK

Road warrior **EXCELLENT**

DOS applications **EXCELLENT**

Windows applications **GOOD**

VENDOR SERVICE & RELIABILITY

Reliability **EXCELLENT**

Repair service **AVERAGE**

Technical support **AVERAGE**

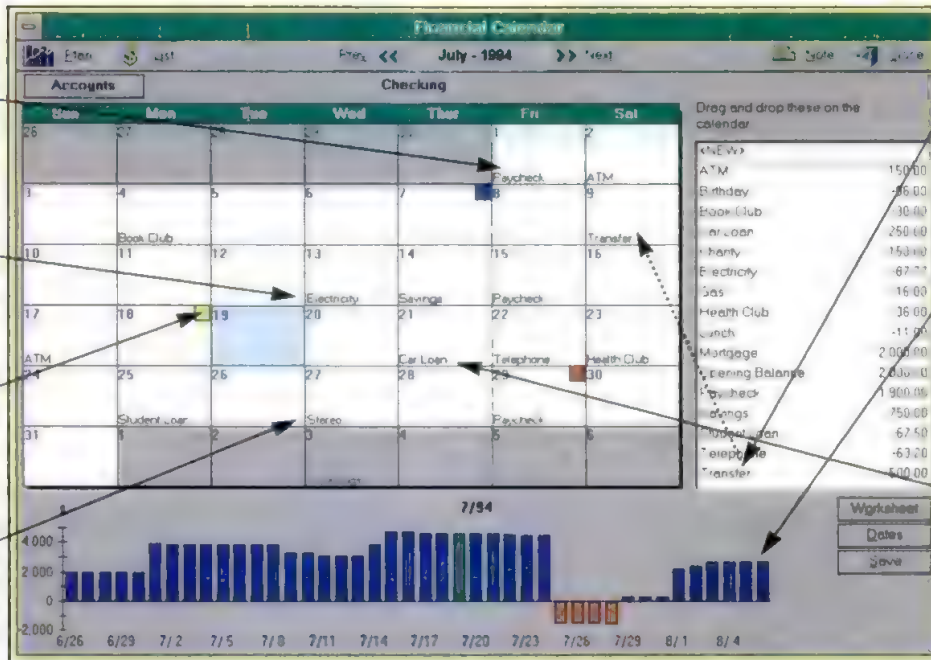
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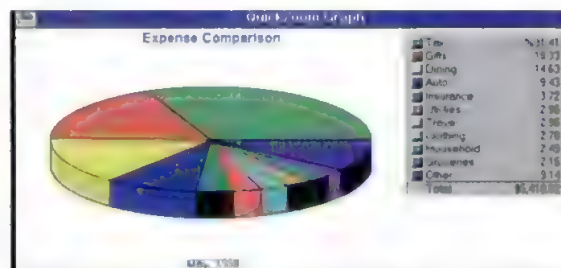
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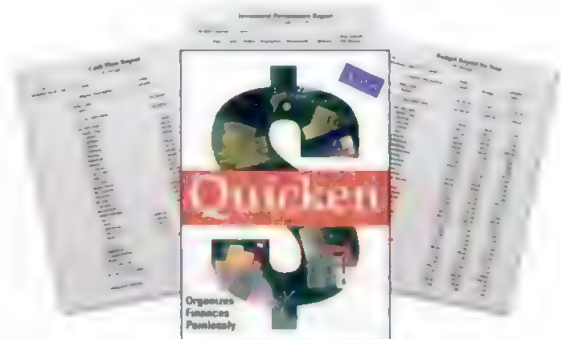
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■ Computo-Sportif: Olivetti's Quaderno 33

If all that mattered in portable computing were looks, the Olivetti Quaderno 33 would be an instant hit. Yet despite its sleek Euro-design and advanced features, "fashionable" compromises are apparent.

The Quaderno's tiny, cramped keyboard has 14-mm keys that offer little feedback. But it is serviceable though slow once you get used to it.

The unit's bright spot is the trackball mounted in the upper-right corner of the case. Two buttons next to the trackball and an auxiliary actuation button on the side of the unit allow index-finger-and-thumb control. The 6.75-inch backlit monochrome screen is adequate, but images are muddy.



While this system is small (1.8 by 8.3 by 6 inches—HWD) and light (travel weight, 4.6 pounds), it is slow. Using an AMD 386/20 SXLV CPU, this unit lagged on all our tests. On the plus side, Olivetti North America says its nickel cadmium battery allows up to

6 hours of operation per charge.

The Quaderno also sports a built-in digital voice recorder. But an hour of audio data may eat up 14MB of a 60MB hard disk, although a 120MB disk is available. The quality of the internal sound system and speaker is fine for voice playback but is not sufficient for music.—*Brian Nadel*

► FACT FILE

Olivetti Quaderno 33
Olivetti North America Inc., 800-633-9909
List price: \$1,750.
Configuration: AMD 386 SXLV-20, 4MB RAM, 60MB Seagate 9080A hard disk, integrated trackball, 14,400-bps PCMCIA data/fax modem, Circle 455 on reader service card

Diplomat, and ZDS Z-Lite come with external keyboard and VGA ports. Most of the subnotebooks come with proprietary external floppy disk drives. The exception is the HP OmniBook, which doesn't come with a floppy drive though you can buy one from a third party; other-

wise, you can use the included file-transfer software and a cable, or you can use an IR connection to another PC.

IBM uses the same proprietary port to connect both a serial device and an external floppy disk drive at the same time. The Toshiba Portégé comes with standard serial and parallel ports. It has a special adapter to connect to an external VGA monitor. Or you can buy a \$239 port replicator that attaches to a proprietary port on the back.

While you can't judge a book by its cover, a subnotebook's case speaks volumes. The Packard Bell Diplomat and ZDS Z-Lite design was one of the first, and it's still one of the best. Styled by industrial design specialists—frogdesign—the ZDS Z-Lite and Packard Bell Diplomat have angled keyboards and look like wedges when closed. Everything about these machines has been well conceived, right down to the look: the design of the external floppy disk drive matches the system unit. Unlike many external floppy disk drives, it looks good on a desk. The power supply can be attached to the external floppy disk drive to create a cohesive unit, or it can be used independently.

The other subnotebooks with outstanding case designs are the Toshiba Portégé and the IBM ThinkPad. At the low-end of the spectrum are the Aspen Starlite, Altima Traveler, Epson Action-

Note and Twinhead SubNote, which have cases that seem to be less well thought out in terms of pointing-device placement and



► FACT FILE

Packard Bell Diplomat 170M Subnotebook

List price: \$2,150 (estimated). Tested configuration: 4MB RAM, 170MB Seagate ST9190 IDE hard disk with 102K buffer, 14,400-bps PCMCIA data/fax modem, DOS 6.0, Microsoft Windows 3.1, Microsoft Works 2.0, Microsoft Money 2.0, Microsoft Productivity Pack, Microsoft Entertainment Pack. Option: 20MB RAM upgrade, \$279.

In short: The Packard Bell Diplomat 170M Subnotebook is a well-designed system that offers solid performance at a competitive price.

SUITABILITY TO TASK

Road warrior **GOOD**

DOS applications **GOOD**

Windows applications **GOOD**

Packard Bell Electronics Inc., 818-886-9998

On reader service card



► FACT FILE

Toshiba Portégé T3400CT

List price: \$3,999. Tested configuration:

4MB RAM, 120MB Toshiba MK1522FCV IDE hard disk with 128K buffer, DOS 6.0, Microsoft

Windows 3.1. Options: 4MB RAM upgrade, \$399; 8MB RAM upgrade, \$738; battery pack, \$329; battery recharger, \$299; PCMCIA 14,400-bps data/fax modem, \$469.

In short: The only unit in this roundup with an active-matrix color screen, this unit sets a new standard in usability and performance.

SUITABILITY TO TASK

Road warrior **GOOD**

DOS applications **EXCELLENT**

Windows applications **EXCELLENT**

VENDOR SERVICE & RELIABILITY

Reliability **ABOVE AVERAGE**

Repair service **AVERAGE**

Technical support **ABOVE AVERAGE**

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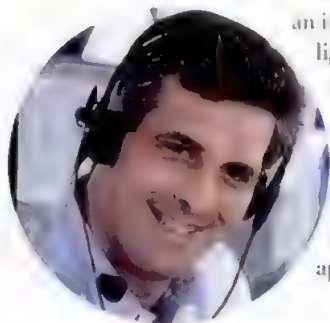
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14L8 (IBM Credit Lease: \$62/mo.) \$1,719*

433DX/Si

486DX/33MHz,† 212MB HD, 4MB RAM
14L8 (IBM Credit Lease: \$66/mo.) \$1,829*

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i486DX2/66MHz, 212MB HD, 4MB RAM
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14L8 (IBM Credit Lease: \$57/mo.***) \$1,589*

433DX/D

486DX/33MHz,† 212MB HD, 4MB RAM
14L8 (IBM Credit Lease: \$70/mo.) \$1,939*

450DX2/D

i486DX2/50MHz, 340MB HD, 4MB RAM
14L8 (IBM Credit Lease: \$81/mo.) \$2,259*

466DX2/D

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14L8 (IBM Credit Lease: \$93/mo.) \$2,569*

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i486DX2/66MHz, 424MB HD, 8MB RAM
14L8 (IBM Credit Lease: \$108/mo.) \$2,989*

466DX2/T

i486DX2/66MHz, 527MB HD, 8MB RAM
14L8 (IBM Credit Lease: \$113/mo.) \$3,129*

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■ More Than a Subnotebook: *Panasonic CF-1000A*

The \$1,999 Panasonic CF-1000A is a full-size notebook masquerading as a subnotebook. Unlike a subnotebook, however, it has an internal floppy disk drive but no PCMCIA slots or internal pointing device. Ready for the road, this system weighs just over 6 pounds. Its full-size case houses a monochrome LCD display and a full-size keyboard.

Powered by a Cyrix 25-MHz 486SLC CPU, the CF-1000A had mid-range scores on our benchmark tests, but it ran for more than 3 hours on our battery test. And if you don't need to use the internal floppy disk drive, you can slide it out and replace it with a second battery to increase battery time. This unit has many power-saving



features, one of which puts the CF-1000A into mode.

Although it doesn't have a PCMCIA socket, the CF-1000A has a full complement of ports, including an internal modem slot. In addition to parallel, serial, and external VGA

ports, this notebook has a 200-pin connector for a docking station. It also has a mouse/keyboard port that you must use for a mouse since the machine does not come with a built-in pointing device. Its 80MB hard disk is a bit small for a full-size notebook, but a 170MB drive is available as an option.—C.B.

► FACT FILE

Panasonic CF-1000A
Panasonic Communications & Systems Co., 800-742-8086, 817-571-1895

List price: \$1,999.

Configuration: *Cyrix Cx486SLC/e-25, 4MB RAM, 80MB Seagate ST9100A hard disk, DOS 5.0, Microsoft 3.1, Superstor.*

Circle 456 on reader service card

keyboard characteristics, and that do not reflect the same degree of high-quality of workmanship.

LOOK BEFORE YOU LEAP

Because of the special nature of this class of PCs, we decided to throw a software

curveball by seeing how well each system could handle running the graphics-intensive Taxi program from News Electronic Data. This database application finds and displays restaurant locations on a street grid for several major U.S. cities; Only the Toshiba Portégé, with its combination of processing power and color screen, was able to adequately handle this task.

Before buying a subnotebook, you must seriously consider what you'll be using it for. Do you require the best battery life for long days on the road? What about the keyboard? Could you write that attention-getting memo with cramped fingers? Will a monochrome LCD panel suffice, or do you crave color? Do you run mostly DOS applications, or are you a Windows or OS/2 maven? And what about connectivity? Do you need a built-in modem, or will PCMCIA suffice? Buying a subnotebook is often an exercise in trading off these options.

If the goal of the subnotebook was to provide a no-compromise computer with a screen, keyboard, and complement of features equal to those of a full-size notebook—or nearly so—only the Toshiba Portégé would measure up. Unlike any other subnotebook, this machine has a 7.8-inch active-matrix color LCD panel that lets you work in

Windows as you would normally, and it has an embedded pointing device that is easy to use once you become comfortable with it. □



► FACT FILE

Twinhead SubNote 4DX/33M

List price: \$2,195. Tested configuration: 4MB RAM, 126MB Toshiba MK-1522FCV IDE hard disk with 128K buffer, 14,400-bps send/receive fax modem, DOS 6.1, Microsoft Windows 3.1. Options: Intel 486DX2/66 processor upgrade, \$300; 4MB RAM upgrade, \$280; 170MB hard disk, \$200. In short: The Twinhead SubNote 4DX/33M is a quality subnotebook that combines a powerful processor, long battery life, PCMCIA capability, and an affordable price.

SUITABILITY TO TASK

Road warrior **GOOD**

DOS applications **EXCELLENT**

Windows applications **GOOD**

Twinhead Corp.,
800-995-8946
408-945-0808

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► FACT FILE

ZDS Z-Lite 425L Model 170W

List price: \$1,999. Tested configuration: 4MB RAM, 170MB Seagate ST9190AG IDE hard disk with 120K buffer, DOS 6.0, Microsoft Windows 3.1. Options: 4MB RAM upgrade, \$279; nickel hydride battery, \$159; PCMCIA 14,400-bps data/fax modem, \$559; PCMCIA Ethernet LAN adapter, \$299; PCMCIA Token Ring adapter, \$579. In short: The ZDS Z-Lite 425L Model 170W sets the standard for integrating components in a trend-setting design.

SUITABILITY TO TASK

Road warrior **GOOD**

DOS applications **GOOD**

Windows applications **GOOD**

VENDOR SERVICE & RELIABILITY

Reliability **POOR/AVERAGE**

Repair service **POOR/AVERAGE**

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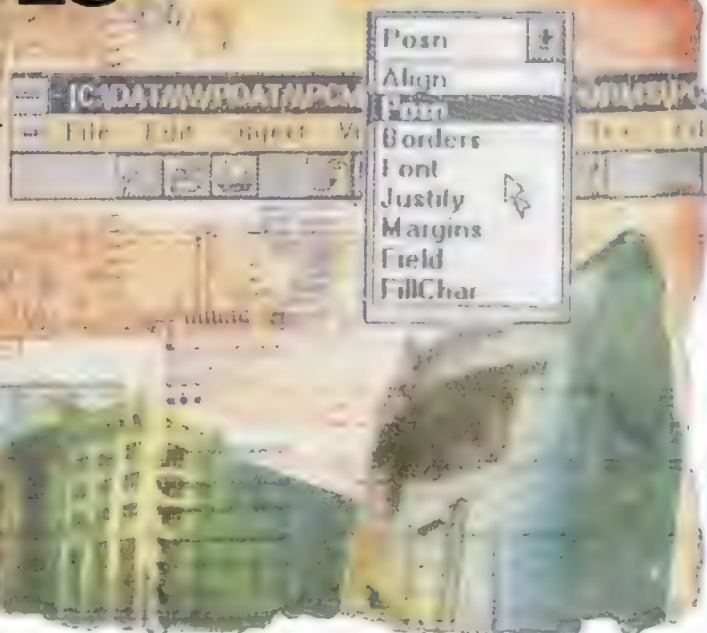
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Today's electronic forms software packages take advantage of mature messaging APIs to distribute electronic forms in a way that may offer a peek at tomorrow's paperless office.



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Few people type away on their IBM Selectrics anymore, and even fewer bang out stories on their old Smith Corona portables. Yet, time and time again, we are asked to take pen and clipboard in hand and fill out a form in a government agency office, at the doctor's office, or at work. For a time, electronic forms technology managed only to aid and abet this paper-pushing culture. But in the two years since our last electronic forms software roundup ("Form and Content: Five Electronic Forms Packages," November 12, 1991), networking, better forms-creation technology, and intelligent e-mail APIs such as MAPI (mail application programming interface) and

By Lance Ulanoff and Jeff Mace

HIGHLIGHTS

Electronic Forms Software

FORMS CREATION is shifting from the electronic reproduction of printed forms to products such as BeyondMail Forms Designer, which allow you to create and distribute forms that need never leave the computer.

MOST OF THE PRODUCTS reviewed here require you to make a serious commitment, either to the concept of the paperless office or to the purchase of additional software.

DELRINA didn't just update PerFORM Pro; the company replaced it with FormFlow, a new, far more robust product, which features strong e-mail support, database access (including SQL support), and new routing abilities.

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ing strong database linking, support for electronic signature encryption and approved signoffs, and excellent print quality.

INTELLIGENCE IS NOW A PART of electronic-forms products such as BeyondMail Forms Designer, which features sophisticated rule-based routing abilities.

JETFORM'S CROSS-PLATFORM support enables all the users on a network to access and fill in forms, even if they're working on different platforms.

VISUAL BASIC AFICIONADOS will find their forms tool of choice in Microsoft Electronic Forms Designer. Just don't expect quality printed output or electronic signature encryption.

VIM (vendor-independent messaging) have coalesced into a viable solution. This new breed of electronic forms designers and fillers can help remove the clipboards from our hands, the clutter from our filing cabinets, and a little bit of the guilt about the world's shrinking forests from our minds.

Most of today's electronic forms packages can still duplicate and print organizational forms. But now, products such as WordPerfect InForms, Version 1.0, and Delrina FormFlow, Version 1.0, invite forms designers to build functionality into every electronic form. Database links to form fields are commonplace, as are radio buttons, drop-down boxes, and automated routing routines. In fact, some forms never leave the computer screen. They are part of a paperless office: created by a designer on the PC, routed across a network, filled in on a PC, and ultimately stored on a server with the necessary data extracted, linked, and manipulated within a database.

LAY OF THE LAND

With all the recent changes in forms software, users now have a number of deci-

sions to make when deciding which forms package to purchase. Do they want printed forms, a paperless office, or the ability to support both?

When we set out to select the products for this review, we were well aware of the fragmented landscape of forms software. Users still want to design forms for printed output, and they demand that each form pass what is sometimes called the "light" test. In other words, if two forms were sandwiched together and held up to a light, every element—including, font, point size, kerning, box size, placement, and line weights—should perfectly match.

Of course, traditional printed forms are still supported by most of these packages. Most can print out a form, or one that's a reasonable facsimile of what was created on-screen. But the questions users must address when trying to make forms-

software buying decisions are not really about whether or not their HP LaserJet printers are supported. Instead, support for multiple message-handling systems and platforms is more important. Can both DOS and Windows users fill in the same form? What about the person using a Macintosh? Does the electronic forms package work with your preinstalled e-mail system, or do you have to adopt a new one? And what if you're not ready for a paperless office? Can you print out multipage forms?

On the other hand, users conscious of the Earth's dwindling resources, and equally aware of their own files overflowing with their companies' forms, now look to electronic forms software as a first step in implementing a paperless office. To do that, however, these forms packages should speak multiple platform and message-transport languages to ensure that no one desk or department in an organization becomes an island.

THE CONTENDERS

In the end, the five products we selected (BeyondMail Forms Designer, Release 2.0; Delrina FormFlow, Version 1.0; JetForm, Version 3.1; Microsoft Electronic Forms Designer [Microsoft EFD], Version 1.0; and WordPerfect InForms, Version 1.0) seem caught between these worlds, with only FormFlow equally at home in either of the two. All of the products we evaluated support complex forms design, database links, and routing; feature a fill-in component; and work with at least one e-mail system. There are a few caveats, however: Only JetForm can create forms that can be filled in under DOS and Microsoft Windows and on the Macintosh. BeyondMail Forms Designer, along with most of the packages we tested, limits the full complement of its features and functionality to its native e-mail system, and some packages do not support multiple platforms.

One product, FormFlow, did in fact outshine the rest, but that still doesn't mean it's

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EDITORS' CHOICE

• Delrina FormFlow, Version 1.0

the forms package for everyone. JetForm seemed out of step with the others, but that's only because the new version had not been released in time for our testing. Graphics Development International's WindFORM, Version 2.0, and BLOC Development Corp.'s F3 Forms Automation System, were not formally reviewed against the others because the current shipping products did not support routing based on if-then rules. But the next version of F3, which was in beta testing at the time of our roundup, does that and more (discussed in the sidebar "F3 Forms Automation System"). The next version of WindFORM (800-989-4434), which is scheduled to ship by midyear, is also expected to include some of these new features.

We also considered another product, one that seems to stretch across numerous categories: Lotus Development Corp.'s Lotus Notes, Release 3.0. Although it may not be what one would consider a traditional forms designer and filler, many companies employ it for just that purpose. What Lotus Notes lacks (without the help of third party add-on products) is a real condition rules-based routing system. And like Microsoft EFD and BeyondMail Forms Designer, it doesn't offer the quality of printed output many people demand from these products.

POINT TO POINT

One of the key enhancements we discovered in the new and updated products we tested is their routing capabilities. The ability to draw an invisible line through the halls of your organization and have the form follow that path, complete with the understanding of which direction to take at a fork in the road, has turned electronic forms design into a truly useful workgroup tool.

Quickly fading are the days when only the art department used a forms package simply to recreate all of the company's favorite forms. These forms are now veritable interfaces with a slew of programming underneath and a whole series of preprogrammed decisions to make after they have left the designer's hands. Sophisticated scripting languages and better user interfaces certainly ease the tasks of routing the forms and filling them in. But if you do use one of these products, be prepared to do

Electronic forms design is changing. While support for paper output continues to be as strong as ever, the paperless office is now a real possibility. Among the products we reviewed, both of these paradigms are represented. But for now, no product we evaluated

stands as ready to generate both standard printed forms and electronic forms as Delrina FormFlow, Version 1.0. As a result, it earns our Editors' Choice award.

FormFlow sprung from Delrina Corp.'s desire to remake its popular PerFORM Pro product, and in that task the company has succeeded. In addition to FormFlow's strong graphic-design features, the package features healthy database links and a complex application-design script/macro, making it the most versatile product we saw. Equally easy to implement and use, FormFlow stands ready to tie into any MAPI-, MHS-, or VIM-based e-mail system.

Quality printed output is matched by strong "paperless" abilities in FormFlow. Routing is handled by the 200-plus command script/macro language. We were also impressed with FormFlow's wealth of options for packaging data and graphics with forms.

It should be said that none of the products in this review are without merit. But in some cases, users will have to decide if they are ready to separate forms that require quality printed output from those they can auto-

mate, or if they want to adopt a new e-mail system.

BeyondMail Forms Designer, Release 2.0, certainly has strong forms-design abilities, but that's not the case with its printing capabilities. Microsoft Electronic Forms Designer is a special case. It's not really a forms-design package. Instead, it's more of a mini-application-development environment: Every "form" is actually a Visual Basic application. While this gives you more programming flexibility and power than you'll find in almost any other product in this roundup, you won't find printed output or consistent support for other e-mail products.

WordPerfect InForms, Version 1.0, does have strong design tools, but it's difficult to install and also requires that you use WordPerfect Office if you want automated workflow and routing abilities.

A former Editors' Choice winner, JetForm, Version 3.1, has not kept pace with the times. While it's still a capable forms-design and filler tool, it did not perform as well as the other products on our database-handling and multipage-forms tests. An upgrade is expected to bring JetForm up to speed.

more than just copy your travel and expense form; sometimes, implementing these packages can get tricky.

Microsoft EFD is the perfect example. Essentially, every form built within this product is a Microsoft Visual Basic (VB) program, complete with its own .EXE file. The person who fills in one of these forms probably won't know that, but the person who creates it had better speak VB.

All of the products in this roundup let users fill in forms electronically. Also, with most packages, the designer can now choose to link the form directly to a database on the server or to send each form with a small database attached to it, then retrieve the data as the form is filled in and returned. In either case, whether the designer chooses to allow users to access the database directly or collates the numbers later, security is essential.

In fact, security is an important consideration at all levels of forms design, fill-in, and routing. Of the packages that have built-in security features, InForms' security capabilities are by far the most complete. In addition to password protection for signoff, InForms also has security features that can be applied to database-update rights and individual fields. Along with InForms, FormFlow and JetForm use what's known as public key-private key RSA (Rivest-Shamir-Adelman) encryption technology. Network administrators use RSA to generate a public code, or *key*, and a private key for each user. Both keys are encrypted, along with the database records, and a single ASCII code is used to unlock them.

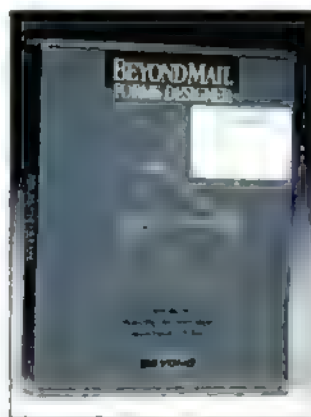
Security, routing, enhanced interfaces: They're all earmarks of the changing electronic forms software industry. And though most of the products in this roundup have taken somewhat different paths, they're all prepared to help you reach the same destination: The design, implementation, and management of complex, intelligent, yet easy-to-use forms.

Beyond Inc.

BeyondMail Forms Designer

BY DON LABRIOLA

Purchasing BeyondMail Forms Designer, Release 2.0, may be a bigger commitment than you bargained for. Not only does this \$495 package require the \$995 e-mail system BeyondMail, Release 2.0 for MHS, Professional Edition (called BeyondMail for MHS hereafter), but it may also force you to adopt Beyond's philosophy of the paperless office. Rather than duplicating existing printed forms, Forms Designer reengineers them into intelligent screen-oriented equivalents better suited for computerized communications. This approach isn't for everyone, but if your goal is a fully integrated electronic information system, few forms packages will



suit your needs as well as this one.

Although Forms Designer runs as a standalone design tool, the forms it creates can only be used on a BeyondMail for MHS system configured with Novell's MHS or Global MHS transport protocol and a compatible DOS- or Windows-based LAN. Forms Designer defines a form's general characteristics and screen layout, but tasks like filling, routing, database access, and printing are all handled by user-generated scripts written in BeyondMail for MHS's rich rule-based language.

Forms Designer is a Windows application, but it generates forms for both the Windows and DOS versions of BeyondMail for MHS. Windows forms can contain a full range of objects, including radio buttons, combo boxes, check boxes, and check buttons. DOS forms aren't quite as slick because of the limitations of DOS BeyondMail for MHS's character-based interface. But Forms Designer still makes the best of the situation, providing reasonable substitutes for most Windows objects.

Forms Software: Glossary

conditional or rule-based routing Essentially a simple form of programming, wherein certain criteria—when met or not met—will determine the route a form takes as it moves through an organization. This kind of routing implies setting certain parameters that determine a form's path based on the information entered on the form.

electronic signature A digitized handwritten signature used as a network security measure. An electronic signature, in conjunction with a password, a user ID, or both may often be required in order to indicate acceptance (for example, a supervisor signing to approve an expense form), to lock other fields on a form against change or deletion, or to hide the contents of locked fields. Used in conjunction with an RSA (taken from Rivest-Shamir-Adelman, the last names of the three scientists who developed this cryptography technology) public key-private key encryption system, electronic signatures provide a practically bulletproof method of ensuring that only intended receivers view a form or selected field.

form locking The procedure of protecting a form from modification after it has been created and

distributed. Users can still open a locked file, fill in the data fields, and use the electronic form as intended by the designer, but none of the items (push buttons, data fields, or graphics) can be moved or changed.

mail application programming interface (MAPI)

A subset of the Windows Open Services Architecture, developed by Microsoft. When using MAPI, application developers can add messaging to any Microsoft Windows application, and the program remains independent from the message storage, transport, and directory services.

mail-enabled application An application that incorporates the functionality of e-mail with its own primary abilities and often provides additional services, such as workflow automation, intelligent mail handling, or contact management. Such an application often lets users send or receive e-mail without exiting a program. Depending on the message-transport mechanism used, an application can be mail-enabled using either an application programming interface (API) or a message-format interface.

message-handling system (MHS) Novell's protocol for electronic-mail management, storage, and exchange. It is application-independent and provides routing services to front-end applications. MHS not only allows for store-and-forward messaging between sites, but also for the transfer of data files and the sending of notifications of a program's status to select users.

routing The process of sending a form to one or more users on a network according to a set of predefined instructions. *Broadcast routing* involves sending a form to multiple users simultaneously. *Sequential routing* involves sending a form to a user, who processes it and forwards it to another user and so on, in a sequence defined by the original user.

vendor-independent messaging (VIM) A message-transfer API like MAPI. When originally developed, its champions included a coalition led by Apple, Borland, IBM, Lotus, MCI, Novell, Oracle, and WordPerfect. VIM is often identified with Lotus alone, however, because the company was the first to release VIM-based products and has been one of its most vocal supporters.

Electronic Forms Software

Suitability to Task:

Electronic Forms Software

There's more to electronic forms software than just forms creation. Because forms are increasingly being handled on your desktop PC as well as on your desk, issues such as database links, data security, and e-mail transport capabilities are important. With that in mind, we designed four tasks that would indicate the strengths of each of these products and how well each can fulfill your electronic forms needs.

In looking at **paper form design**, we rate a package's ability to create and handle multipage forms and its ability to import and manipulate graphics, as well as its degree of specialized support for a variety of printers. To score well, products must supply their own printer drivers, provide fine control over letter and line spacing, and feature sophisticated graphical drawing environments. Also important are the ability to group and ungroup multiple elements, resize or move multiple elements as a unit, and to save and recall named objects. In addition, features such as form templates

and the ability to display true screen fonts, line widths, and imported graphics all work in a product's favor.

For a package to be useful for **electronic design**, it has to provide all the tools necessary to create an easy user interface. Support for Microsoft Windows

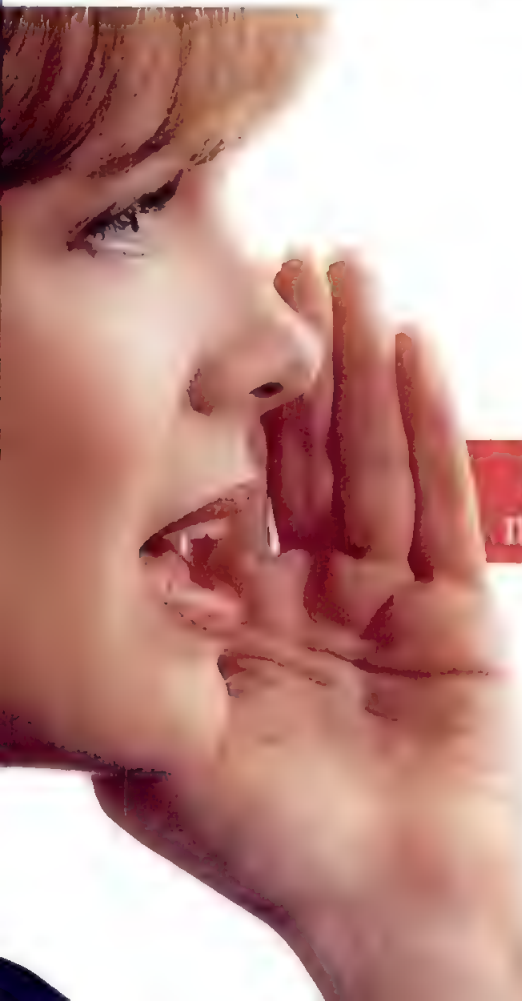
SUITABILITY TO TASK				
Product Name				
	POOR	FAIR	GOOD	EXCELLENT
Paper form design	☒	☐	☐	☐
Electronic design	☒	☒	☐	☐
Fill-in/database linking	☒	☒	☒	☐
Transport/routing	☒	☒	☒	☒
Transport/routing	N/A			

N/A—Not applicable. The product does not perform this task.

user-interface resources, such as radio buttons, nonstatic text boxes, and pop-up boxes with scroll capabilities, is also vital for receiving a high rating. We also look for products that offer well-designed pan and zoom functions and rich grid and snap options for duplicating existing forms with precision.

In order to excel in **fill-in/database linking**, a package must have the ability to update database records, provide for data security, support electronic signatures and encryption, and work with the network bindery. We look for products that handle proportional text, enable you to link to existing database indexes, and allow you to make selections on multiple fields using AND/OR statements.

For **transport/routing**, we rate a package's ability to work seamlessly with at least one e-mail product, and provide support for a number of other mail-handling systems. Products that score well in this area support conditional, rule-based routing and tracking, as well as options for sending forms with data, forms alone, or pointers to forms and data on the server. We look for products that can build routes using an address list, automatically save each completed form either in the mail directory or its own directory, feature a return-to-sender function, and include facilities for confirming routes and performing route or address management. The ability to take advantage of MAPI or VIM to integrate its operations with an e-mail package also work in a product's favor.

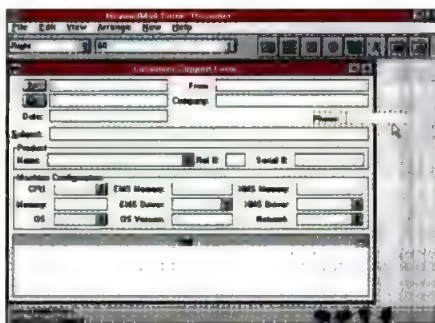


It's about time a computer company listened to my needs. Not just tell me what they think I need.

Installation of Forms Designer is simple if you've already got BeyondMail for MHS running. And if you're starting from scratch, some well-designed installation utilities and Beyond's comprehensive documentation will simplify your efforts.

NOTHING FANCY

You may run into problems, however, if you try to use Forms Designer to create large, complicated forms that contain nonstandard objects. In our testing, we had problems importing graphics such as our fictional company logo (Version 2.1 will be able to import .BMP graphics), and the designer doesn't support electronic signatures or floating-point variables, which makes it hard to build forms that contain currency figures.



BeyondMail Forms Designer features standard Windows 3.1-style objects such as scrolling boxes and radio buttons.

Furthermore, you have no control over fonts or the height of input fields, and you can't create a form larger than the size of your screen. Unless you're working on a fast 486, Forms Designer's constant screen redraws—which get slower as you add more objects—can make

the simplest tasks excruciatingly slow.

None of this is as bad as it sounds if you're willing to restrict yourself to designing forms that have compact, simple layouts, which is obviously how Beyond assumes you will use its product. During our testing, Forms Designer couldn't

precisely duplicate complex printed forms, but it did let us redesign them as less cluttered versions that worked better on-screen. Though Forms Designer couldn't generate multipart forms, rela-

SUITABILITY TO TASK				
BeyondMail Forms Designer				
	POOR	FAIR	GOOD	EXCELLENT
Paper form design	N/A			
Electronic design	●	●	●	○
Fill-in/database linking	●	●	●	○
Transport/routing	●	●	●	●

tively simple sets of rules allowed us to manipulate related single-page forms with all the flexibility we could have wanted.

BeyondMail for MHS's rule-based language is powerful and complex enough to justify training a forms administrator for each site. It lets you create programs that can display dialog boxes, define conditional message routing, perform file and directory maintenance, manipulate variables, execute DDE operations, and even launch other Windows applications. You can force them to execute at a fixed time of day, after a certain period of time has elapsed, or when a user performs actions such as sending an

Boarding Pass

NAME OF PASSENGER: **FALK/DAVID E.**

SEAT: **31A** STATUS: **NO**

FLIGHT: **122** CLASS: **E** DATE: **15 JAN**

FROM: **LOS ANGELES LAX**

TO: **CHICAGO OHARE**

DEPARTURE TIME: **242p** GATE: **12** ARRIVAL TIME:

From the City of Angels to the Windy City or

Boarding Pass



Electronic Forms Software

e-mail message, clicking a button, or storing a message in a folder. The extraordinary functionality of BeyondMail for MHS's rule-based language makes it one of the most impressive tools we've seen for developing intelligent electronic forms applications.

Forms created in Forms Designer can access records in ASCII text files, but the procedure is a poor substitute for a true relational database management system (DBMS). One of the product's greatest strengths, however, is its ability to accept plug-in DLL modules, such as Q+E Software's Database Library. This library product adds a full complement of relational-DBMS rules that allow Forms Designer forms to manage databases created with any of 20 popular packages, including Btrieve, dBase IV, Microsoft SQL Server, and Paradox.

MAIL DELIVERY

BeyondMail Forms Designer's impressive fill-in environment lets you assign a toolbar button to any form and even give the same form several buttons, each of which will trigger a different set of rules. A set of

add-on Mail Minder utilities simplifies standard functions such as routing forms through a sequential distribution list. Although the current version doesn't support MAPI (Version 3.0 should), it can exchange message contents but not form

layouts with any VIM-compliant e-mail package. This enables applications to forward the unformatted contents of BeyondMail for MHS messages to a Lotus Notes workgroup, for example.

The system's other major drawback is its inability to produce professional-looking hard copy. Instead of letting you print on-screen form layouts, Forms Designer

attaches a Print View to each form that specifies how a message's contents will appear when printed by a BeyondMail for MHS user. Unfortunately, Print Views offer only the most primitive character-based formatting, so hard-copy quality never approaches the slick look of Forms Designer's on-screen Windows forms.

Forms Designer has a few rough edges, but its user interface, design methodology, and overall approach are well conceived, and the program does an exceptional job of exploiting the intrinsic strengths of the networked business environment. If you're ready to make a serious commitment to the concept of the paperless office, you'll have a tough time finding a better forms product.

▶ FACT FILE

BeyondMail Forms Designer, Release 2.0
Beyond Inc., 17 New England Executive
Park, Burlington, MA 01803, 617-229-
0006; fax, 617-229-1114.

List price: \$495; BeyondMail, Release 2.0
for MHS, Professional Edition, \$995.

Circle 468 on reader service card

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paperless office, you'll have
a tough time finding a
better forms product than
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anywhere in between, you've got the power.

to "sleep." Once you return and hit any key, you're right where you left off.

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 **TEXAS
INSTRUMENTS**



Performance Tests: Electronic Forms Software

In evaluating these five electronic forms packages, we examined each product's capacity for complex form design. In addition, we looked at each product's proficiency in using conditional rules to route forms via e-mail, the quality of its database links, and the strength of its security features.

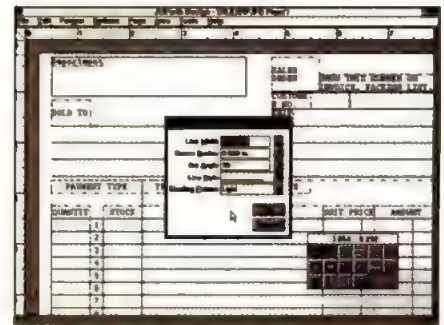
How We Tested

We tested all five packages on our standard test-bed Compaq Deskpro 486/33M systems, each configured with a 310MB IDE hard disk and 8MB of RAM. We configured each test-bed with three workstations and two systems functioning as NetWare 3.11 file servers. To take full advantage of each package's power, we installed the MAPI-, MHS-, or VIM-compliant e-mail system suggested by each forms software vendor.

To test complex forms designed for

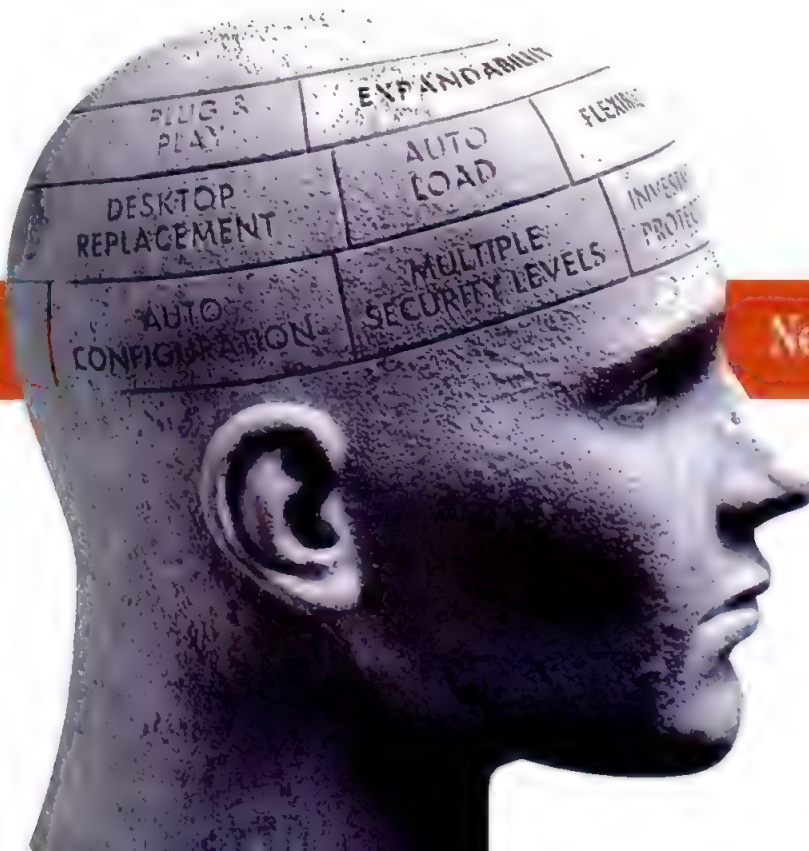
paper output, we duplicated a three-page automobile repair form. We tested each package's ability to format and kern text to within one-half of a point (72 points equals 1 inch). We then used their packages' graphics tools to create shaded rectangles with rounded edges and varying line weights and styles. Next, we attempted to import the fictional company's logo in CGM, .PCX, and TIFF formats.

To evaluate their proficiency in electronic forms design, we exercised the products' 3-D shading capabilities,



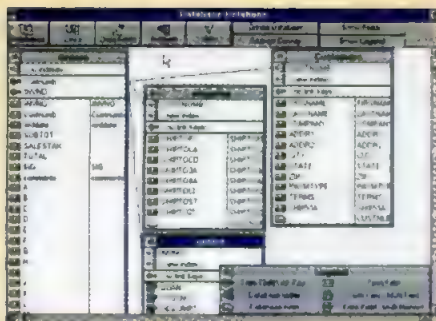
Duplicating our test form required us to make fine adjustments to each of the graphical elements.

action buttons, pop-up scrollable text boxes, radio buttons, and check boxes; these features should make data entry and database searches easy tasks for users. We also looked for special tools to create round check boxes and gradient fills that matched the original form. We tested to see if each product could perform data validation and integrity checks, and verified that the data was located within a specified range. We

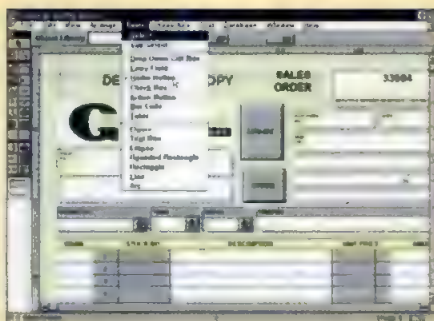


New Intelligent Docking: So smart it

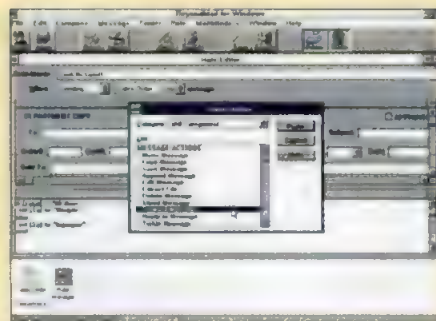




By linking our test form to multiple databases, address and telephone fields were automatically filled after searching for a name.



We designed our electronic form using GUI elements such as radio buttons, pull-down menus, and check boxes.



We triggered an electronic-mail message to be returned to the initiator every time the form stopped along its route.

then set up search fields to handle wildcard searches. After entering all the data into a form, we created invisible fields using electronic signatures to protect databases accessed by users with different network-access levels.

To evaluate a package's fill-in and database-linking capabilities, we stored data on different servers and in different formats. While performing a search based on users' ZIP codes, we linked

fields to expedite data entry and calculate sum totals and tax. We then updated the customer databases and permitted data entry based on inventory tracking levels.

We tested forms routing over the network by using our sample order form, which required data entry and approval by a supervisor. After each package verified an electronic signature, we routed the form to one of two

supervisors, depending on the amount in the Sale Total field. We routed the form to a specified user in the accounts-receivable office, displaying only the appropriate portions of the form. Next, we transported the form to the shipping-receiving department for printing, providing only the data pertinent to that department. Unapproved forms or forms received after a two-day period were then returned to the original user.

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 **TEXAS
INSTRUMENTS**



Delrina Corp.

Delrina FormFlow

BY JOE SALEMI

Delrina Corp. has not only outdone the competition, it has outdone itself. Delrina FormFlow, Version 1.0, takes the capabilities of Delrina's PerFORM Pro, which received an Editors' Choice award in our last forms roundup, and combines them with three new features that let users create sophisticated workflow applications. FormFlow adds support for a number of standard database formats, including SQL database servers, and for routing forms throughout an organization via its e-mail system. In addition, designers can use FormFlow to create complete form applications with the built-in Intelligent Forms Language (IFL). These features, along with others,



make FormFlow an ideal package for replacing paper forms with their electronic equivalents.

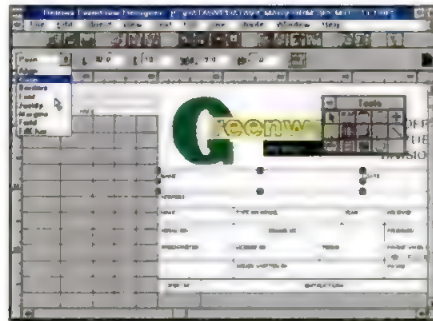
The \$199 Manager Module contains the Microsoft Windows-based FormFlow Designer, FormFlow Filler, and Security Administration programs, as well as a number of sample applications. Additional copies of the filler for either DOS or Microsoft Windows are available in the \$129 User Module package, and a \$399 Starter Kit with the designer and three fillers is also available.

Installing the Manager Module is simple, and you're given a choice of doing a full, minimum, or custom install. The full installation copies over 100 ready-to-use form templates and 7 custom applications, all of which are

described in a separate manual, to the hard disk.

A FULL SET OF TOOLS

FormFlow Designer takes full advantage of the Windows 3.1 interface. The package includes a variety of tools, such as auto-wrapping text boxes, automatic tables that can be customized by columns and rows, and a number of ways to locate objects; these make recreating a paper form on-screen simple. The package also lets you either group objects together to create duplicates,



The FormFlow Designer gives you a wide variety of graphics tools to choose from when designing a form.

or put the objects into a library to be used again in the same or other forms.

One of FormFlow Designer's greatest assets is that it makes it easy for you to build multipart forms. A simple menu choice determines if an object on one



We're listening. We're learning.



page should be duplicated on the next page to avoid recreating it over and over again. Though it only took us about 5½ hours to design our three-page multipart test form, we did run into some problems creating the database links used by the form. The documentation isn't very clear on how to create database links and lookups properly and we ultimately needed help from Delrina's technical support.

Among FormFlow Designer's security features is its full support for electronic signatures. Security IDs and signatures are set up through the Security Administration program, and you can add user IDs directly or import them from the NetWare bindery. Passwords are encrypted using the public key-private key RSA encryption system; signature fields can be used to lock other fields on a form to prevent modification and to hide a form's confidential fields.

FormFlow includes IFL, a script-and-macro language, called the Intelligent Forms Language (IFL), that lets you create complete applications. You can assign IFL macros, which are recorded in the

filler, to buttons on a form, objects on a form, or to the form itself for automating entry and exit functions.

DATABASES AND E-MAIL

FormFlow includes built-in support for dBASE IV and Paradox data files and

*FormFlow takes the highly
rated forms-design abilities
of PerFORM Pro and
extends them to create
complete workflow apps.*

indexes, and a form can access data from multiple sources. A SQL database server access module, which supports IBM DB2/2, Lotus Notes, Microsoft SQL Server, and the OS/2 Database Manager, was in beta testing at the time of our review (it is currently available). The access module was released earlier this

year, and Delrina offers a full rebate to customers who return the postcard found in the package.

FormFlow also excels in its e-mail routing capabilities. IFL is used to create complex automatic routing lists. It includes built-in support for cc:Mail, Lotus Notes, MAPI, MHS, and VIM, and has an e-mail API that lets developers integrate the language into other e-mail systems. One of the sample applications included in the Manager Module is a program that can be used to track the progress of forms sent through the e-mail system.

FormFlow Filler is integrated into the e-mail system so that the recipient of a form can automatically load it and take any actions necessary before sending it on to the next destination. It includes a variety of packaging options that cut down on the size of the file being transferred, including sending only the data for the particular form, or pointers to common database files to which the recipient has access. The only limitation we found was with multipart forms: FormFlow Filler

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Color	486SX-25MHz	4MB RAM/120MB HDD	\$2,249
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Monochrome	486SX-25MHz	4MB RAM/120MB HDD	\$1,899

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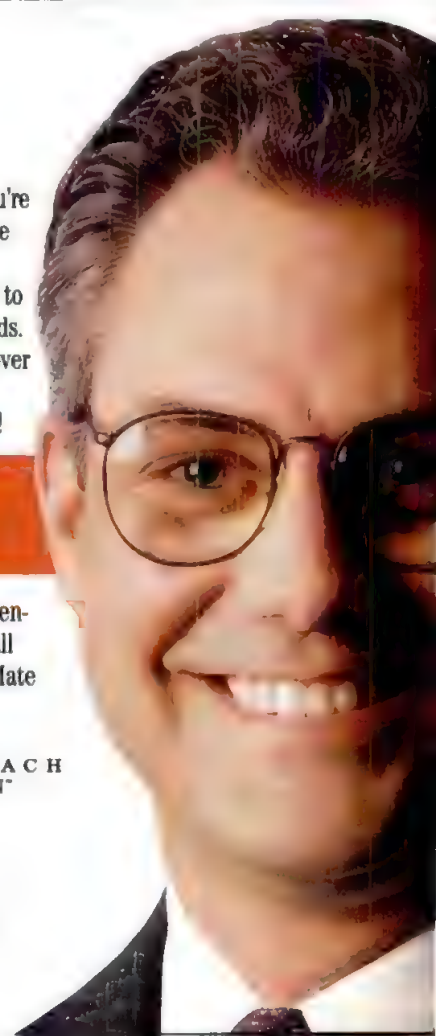
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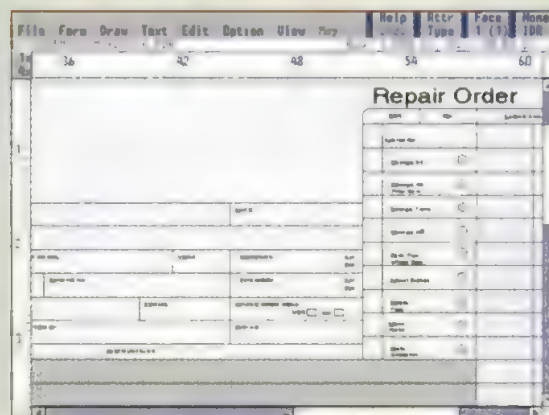
• F3 Forms Automation System

While GUI workgroup software is revolutionizing the way businesses work, there are still tons of printed forms out there, and a good percentage of them were designed with BLOC Development Corp.'s first product, F3 Pro Designer. To address the migration of such paper-hungry organizations to on-screen forms processing, the company created the F3 Forms Automation System, which comprises F3 Design and Mapping, Release 1.5, and F3 Fill, Release 1.5.

F3 Design and Mapping, which is compatible with F3 Pro Designer, enables you to create forms for printing or viewing. F3 Fill is the runtime module that enables users to fill out forms created in F3 Design and Mapping. Because the current version, which

supports e-mail, was still in beta at the time of testing, F3 did not meet our requirements for this roundup (though it is available now). We did, however, take a thorough look at Version 1.5 of both F3 Design and Mapping and F3 Fill and found not just a different type of software program, but a different company philosophy as well.

Unlike the forms software packages reviewed in this issue, F3 is not a shrink-wrapped product meant strictly for user consumption. BLOC markets F3 to IS departments and usually works with its clients to



F3 Design and Mapping provides text-formatting features such as kerning and automatic hyphenation for creating printed forms.

implement a new forms system and to train users. F3 is also an expensive

IT CAPTURED 67% OF THE ANTI-VIRUS MARKET BEFORE IT WAS EVEN IN A BOX.



system to implement: F3 Design and Mapping sells for \$3,000, and each copy of F3 Fill sells for \$300 (in quantities of up to 50).

F3 Fill runs under DOS or Windows (a Macintosh version should be available by the time you read this), allowing cross-platform deployment of forms. Its ability to create highly precise printed forms also endears it to such organizations that have exacting standards for printed material.

The forms designing module, F3 Design and Mapping, runs exclusively under DOS with a mouse-driven interface. Although the menu system is not as intuitive as those of other programs, the program provides an excellent array of drawing tools and alignment options. The drawing grid has separate horizontal and vertical settings and can be defined in various scales including inches, millimeters, mils, and picas.

The process of "mapping" involves

adding the smarts, such as field navigation and database access, to a form. Objects called *datablocks* can be laid down on a form where data entry is to occur, and automation and data validation can then be established. A number

Unlike the forms software packages reviewed here, F3 is not a shrink-wrapped product meant strictly for user consumption.

of predefined data formats can be assigned to datablocks to verify proper entry, and valid data ranges can be defined.

Once a form is designed with F3 Design and Mapping, it can be read by

any of the versions of F3 Fill. While the Fill user sees a paperlike form, entry is not performed directly into it. Instead, pop-up prompt boxes accept input for each field as you navigate around the form.

Because of the steep price of the F3 Automation System, the package appeals mostly to those organizations that already have F3 Pro Designer-created forms to convert into electronic forms, but it should also be considered by users who need precisely printed forms and cross-platform deployment.

▶ FACT FILE

F3 Forms Automation System
BLOC Development Corp., 800 SW 37th Ave., Coral Gables, FL 33134; 800-477-2562.

List price: F3 Design and Mapping, Release 1.5, \$3,000; F3 Fill for DOS, Windows, or Macintosh, Release 1.5, \$300 (quantity discounts available).

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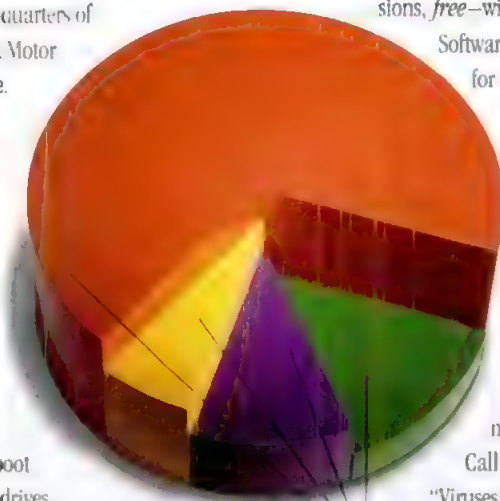
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SUITABILITY TO TASK

Delrina FormFlow

	POOR	FAIR	GOOD	EXCELLENT
Paper form design	●	●	●	●
Electronic design	●	●	●	●
Fill-in/database linking	●	●	●	○
Transport/routing	●	●	●	●

can't send only one page of a form through the e-mail system.

FormFlow uses the Windows printing drivers and includes special support for HP LaserJets. Forms can be printed on a LaserJet in regular, fast, or extra-fast modes, all of which were acceptable speeds. FormFlow also supports downloading forms as macros to HP printers. However, the product unfortunately suffers from the limitation we found in PerFORM Pro that only lets the first page of a multipart form download as a macro. According to Delrina, to print a multipart form via a macro you need a printer with 4MB to 5MB of RAM. A planned product revision will include a pop-up dialog box that warns you if you

don't have enough memory. The print quality from both LaserJet and PostScript printers was excellent.

FormFlow takes the highly rated form-design capabilities of PerFORM Pro and extends them into the area of creating complete workflow applications. The addition of the Intelligent Forms Language makes creating sophisticated yet easy-to-use forms applications a breeze. FormFlow's tight integration into various e-mail packages makes it ideal for replacing a paper trail of forms with its electronic equivalent. FormFlow sets the standard for other forms packages.

►FACT FILE



Delrina FormFlow,
Version 1.0

Delrina Corp., 6830 Via Del Oro, #240,
San Jose, CA 95119; 800-268-6082; fax,
408-363-2340.

List price: *Manager Module (includes FormFlow Designer and one copy of FormFlow Filler), \$199; User Module (one filler), \$129; Starter Kit (includes the designer and three fillers), \$399.*

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JetForm Corp.

JetForm

BY ALFRED POOR

There's an old blues song with the refrain, "born under a bad sign," and it may be the theme song at JetForm Corp.,



where the next generation of the company's forms software was in beta stage when the time came to test products for this round-up. As a result, we ended up testing Jet-

Form, Version 3.1, which still closely resembles the version that shared Editors' Choice honors when we last covered this category. While JetForm is still a capable product, it was not able to manage many of the tasks we set for it in this round of testing—tasks that the next version is expected to handle with ease. Thus, the program did not make the

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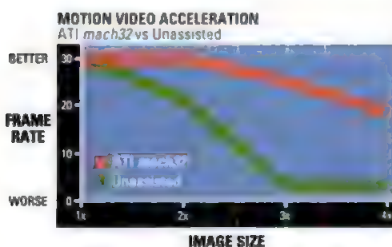
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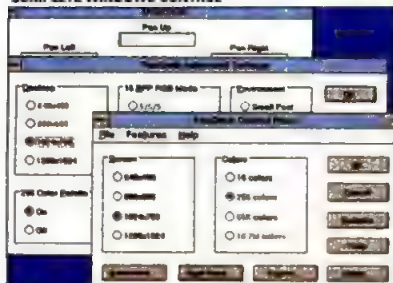
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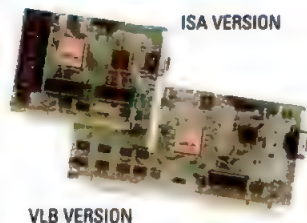


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SUMMARY OF FEATURES

CONTINUES

Electronic Forms Software



Products listed in alphabetical order

■ = YES □ = NO

	BeyondMail Forms Designer, Release 2.0	Delrina FormFlow, Version 1.0	JetForm, Version 3.1	Microsoft Electronic Forms Designer, Version 1.0	WordPerfect InForms, Version 1.0
List price	\$495; BeyondMail 2.0 for MHS, Professional Edition, \$995	Manager Module, with designer and one filler, \$199; Starter Kit, with designer and three fillers, \$399	JetForm Design, with one filler, \$495; five-user version, \$1,995; JetForm for E-Mail, five-user version, \$495	With designer and one filler, \$395; Microsoft Visual Basic, Professional Edition 3.0, \$495	With designer and one filler, \$495; five-user version, \$1,425

General Features

DDE support	■	■	■	■	□
Version of OLE supported	1.0 (client)	1.0 (client, server)	None	2.0 (client)	None
Network support:					
NetBIOS	■	■	■	■	■
NetWare	■	■	■	■	■
VINES	■	■	■	■	■
Can be run from server	■	■	■	■	■
Can share network printers	■	■	■	■	■
Database record locking	■	■	□	■	■
File locking	■	■	■	■	■
Assign text descriptions to forms	□	■	■	■	□
Platforms supported for fill-in	DOS, Windows	DOS, Windows	DOS, Macintosh, Windows	Windows, Windows NT	Windows

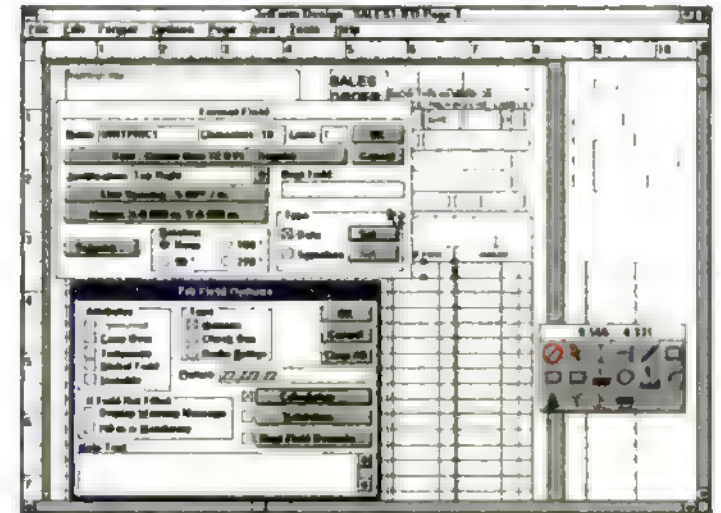
Forms Creation and Editing

Platforms supported	DOS, Windows	Windows	Windows, Windows NT	Windows	DOS, Windows
Customizable templates	■	■	■	■	■
Create and save named objects	□	■	□	■	■
Drawing primitives:					
Arc	□	□	■	□	■
Box	■	■	■	■	■
Drop shadows	□	□	□	■	■
Guidelines	□	■	■	■	■
Rounded corners	□	■	■	■	■
Circle	□	■	■	■	■
Orthogonal line	■	■	■	□	■
Polyline	□	■	□	□	■
Form layout:					
Multipage forms	□	■	■	■	■
Preformatted sizes	□	■	■	□	■
Set custom form size	■	□	■	■	■
Form Elements					
Bar codes	□	■	■	□	■
Check boxes	■	■	■	■	■
Check circles (radio buttons)	■	■	■	■	■
Color options:					
Number of colors supported	16	16	1	256	256
Define custom colors	■ (DOS only)	■	□	■	■
Define custom palettes	■ (DOS only)	□	□	■	■
Fields	■	■	■	■	■
Grid or table elements	□	■	■	■	■
Line options:					
Number of predefined line widths	None	12	7	32,767	16
Variable line widths	■	■	■	■	■
Number of line end styles	None	6	1	None	3
List boxes	■	■	■	■	■
Scroll bars	■	■	■	■	■
Shading options:					
Background	■	■	■	■	■
Gradient fills	□	■	□	■	■
User-definable gray percentage	□	■	■	■	■
User-definable patterns	□	□	□	■	□
Show or suppress borders	■	■	■	■	■

N/A—Not applicable. The product does not have this feature

strong showing it did last time.

At the core of the JetForm product line is JetForm Design, a Microsoft Windows application that you use to design and compile forms files. These files are then used by the JetForm Filler program, available in Windows, DOS, and Macintosh versions, which allow users to fill in the blanks on the forms and store the results in a proprietary database format.



JetForm offers a wide range of field-definition features, many of which can be accessed directly via a series of dialog boxes.

Our testing focused on the Windows versions of the programs. Installation was fairly straightforward for the designer and single-user filler, but the networked e-mail version required a fair amount of fussing with individual configuration .INI files, directory rights to various shared and private directories, and the NetWare log-in script so that each user had the correct search paths defined.

DESIGNING FORMS

Designing forms in JetForm is straightforward and easy. A moveable toolbar provides you with quick access to most of the important features. You can customize it by adding buttons that you define as a series of commands, which is somewhat inferior to a complete macro facility but still helpful. JetForm doesn't feature a "comb" tool for drawing parallel lines (though Version 4.0, which should be available by the time you read this, will have a comb feature), but the intelligent copy and paste feature provides the same benefits and more once you learn how to use it to its full advantage.

JetForm Design has a time-saving feature for duplicating an existing form: You take a TIFF image of a scanned form and use it as a backdrop for your duplicate.

SUMMARY OF FEATURES

CONTINUES



Products listed in alphabetical order

■ = YES □ = NO

Editing Commands

Align objects	■	■	■	■	■
Cut, copy, and paste objects	■	■	■	■	■
Duplicate objects	□	■	■	■	■
Group and ungroup objects	■	■	■	■	■
Move objects to front and back	□	■	□	■	■
Rotate objects	□	■ (text only)	□	□	□
Undo and redo	□	■	■	■	■

Graphics Handling

File formats imported:

.BMP	■	■	□	■	■
.EPS	□	■	□	□	■
.GIF	□	■	□	□	□
.PCX	□	■	■ (black and white only)	□	■
TIFF	□	■	■ (black and white only)	□	■
WMF	□	■	□	■	■

Text Handling

Supports TrueType and Type 1 fonts	■	■	■	■	■
Text-alignment options:					
Full-justify text	■	■	■	■	□
Hyphenate	■	□	□	□	□
Indent text	□	■	■	■	□
Rotate text	□	■	■	□	□
Word wrap	■	■	■	■	■
Text-fitting functions:					
Grow box to fit text	□	■	□	□	■
Shrink text to fit box	□	□	□	□	■
Type-specification controls:					
Justify field labels	■	■	■	■	■
Leading	□	□	■	□	□
Spell-checking	□	■	■	□	■
Tracking and kerning	□	□	□	□	□

Page Measurement

Can separate horizontal and vertical grids	□	■	■	■	■
English and metric	□	■	■	■	■
Keystroke macros	□	■	□	□	■
Measuring tool	□	■	■	■	■
Points or picas	□	■	■	■	■
Can set grid size	□	■	■	■	■
Snap options	□	■	■	■	■
Grids	N/A	■	■	■	■
Objects	N/A	□	■	■	■
Rulers	N/A	□	■	□	■
Workspace control:					
Manual redraw	□	■	□	■	■
Scroll or pan	□	■	■	■	■
Zoom	□	■	■	□	■
Variable increments	N/A	□	■	N/A	■

Date File Handling

Directly reads/writes:					
ASCII	■	■	■*	■	■
Btrieve	□**	□	□	□**	■
dBASE IV	□**	■	■*	□**	■
Microsoft FoxPro	□**	□	□	■	■
Microsoft SQL Server	□**	□	□	■	■
Paradox	□*	■	■	□**	■
Sybase SQL Server	□**	□	□	■	■
Index support:					
Attach or detach indexes	□**	■	■	■	■
Create indexes	□**	■	□	■	■
Can Update attached indexes	□**	■	□	■	■

N/A—Not applicable. The product does not have this feature.

*Users may query and update database only once per form. **This feature is available only by means of a third-party add-on product.

On the other hand, the program is woefully inadequate when it comes to creating or importing graphics: Images are only in black and white and cannot be cropped or scaled once imported.

JetForm can create multipart forms with relative ease, though you must create a separate field for duplicate information on subsequent pages. Our testing called for limiting which pages certain users could see, a function that is not supported by the program. The only way to perform this task is to create separate forms and place the appropriate drafts in each user's private directory.

JetForm does support electronic signatures, however. What's more, a valid electronic signature can trigger automatic locking of data in any field on the form, thus preventing changes after approval.

DATABASE DEFICIENCIES

One area in which JetForm shows its age is in its database handling. While it can read data from dBase IV files for lookups, we found the process of creating these links to be cumbersome. You cannot tap dBase index files, and although you can update or add records to the dBase file, this can only be done once per form. For creating databases, all data must be written to a proprietary JetForm database; if you want to use that data elsewhere, you must first export it as a comma-delimited ASCII text file.

SUITABILITY TO TASK

JetForm

	POOR	FAIR	GOOD	EXCELLENT
Paper form design	●	●	●	●
Electronic design	●	●	●	○
Fill-in/database linking	●	●	○	○
Transport/routing	●	●	●	○

We tested JetForm for E-Mail using cc:Mail, which JetForm supports using VIM. The program supports other e-mail APIs, including MAPI and MHS. Forms sent as messages appear as icons in a message; you double-click on the icon to open the filler with the form loaded.

JetForm makes full use of an e-mail package's address-book features, including routing. It's easy to build in logical tests for branching so that a form will be

More

More

[illegible]

1. The first step is to identify the problem. This involves understanding the symptoms and the context in which they are occurring.



ThinkPad 350C (color)

- 486SL, 25MHz processor with 8KB internal cache
- 4MB RAM/250MB hard drive, 3 1/2" 1.44MB diskette drive
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 - PCMCIA slot
 - IBM DOS preinstalled
- 1-year international traveler's warranty

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\$108/mo.**

ThinkPad 350

- 486SL 25MHz processor w/ 8KB internal cache
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SUMMARY OF FEATURES

ENDS



Products listed in alphabetical order

■ = YES □ = NO

	BeyondMail Forms Designer, Release 2.0	Delrina FormFlow, Version 1.0	JetForm, Version 3.1	Microsoft Electronic Forms Designer, Version 1.0	WordPerfect InForms, Version 1.0
Data File Handling (continued)					
Data-import formats:					
ASCII (comma-delimited)	■	■	□	■	■
ASCII (fixed-field)	□	■	■	■	■
ASCII (print-image)	□	□	□	□	■
ASCII (tab-delimited)	■	■	□	■	■
.WK?	□**	□	□	□	□
.XLS	□**	□	□	□**	□
Data Entry and Validation					
Automatically sizes text in data entry	□	□	□	□	■
Calculations:					
Auto-incremented form numbers	□	■	□	■	■
Automatic date and time	■	■	■	■	■
Calculated fields	■	■	■	■	■
Define field movement order	■	■	■	■	■
Field rules:					
Conditional skip	■	■	■	■	■
Default values	■	■	■	■	■
Edit masks	■	■	■	■	■
Protect fields	■	■	■	■	■
Range verification	■	■	■	■	■
Lookup functions:					
In tables	■	■	■	■	■
In external database	□	■	■	■	■
Maintains user list	■ (via BeyondMail)	□	■	■	■
Supports aliases	■ (via BeyondMail)	■	■	■	■
Routing and Security					
E-mail APIs supported:					
MAPI	□	■	■	■	■
MHS	■	■	■	□	■
VIM	■	■	■	□	■
Electronic signature	□	■	■	□	■
Encryption	■	■	■	□	■
Track forms	■	■	■	□	■
Supports rule-based routing	■	■	■	■	■
Can use address lists	■	■	■	■	■
Confirm path	■	■	■	■	□
Perform route and address management	■	■	■	■	□
Output Options					
Supports Windows printers	■	■	■	■	■
Forms-overlay support:					
Compile forms as downloadable files	□	■	■	■	■
Download forms as macro overlays	□	■	■	□	■
Fast-print mode	□	■	■	□	■
Store print information with form	■	■	■	■	■
Printing Options					
Background printing	■	□	■	■	■
Color handling:					
Print in color	□	■	□	■	■
Suppress colors	N/A	■	N/A	■	■
Convert colors to gray shades	N/A	■	N/A	■	■
Draft mode (low resolution)	□	□	■	■	■
Print data or form only	□	■	■	■	■
Print preview	■	■	□	□	■
Print to file	■	■	■	■	■
Documentation and Support					
Paper-based/on-line tutorial	□□	■	■□	■	■
Sample forms	■	■	■	■	■
Context-sensitive help	■	■	■	■	■
Toll-free technical support	■	□	□	■	■
Free technical support	■	■	■	□	■
BBS support	CIS	CIS, company-run	Company-run	CIS	CIS, company-run

N/A—Not applicable. The product does not have this feature. *This feature is available only by means of a third-party add-on product.

sent as a message to one address under one condition but to another address if that condition is not met. JetForm doesn't feature route tracking, but you can request a notification for each time the form is sent to the next address on the route.

JetForm truly shines when it comes to printing. The quality of its printed output in our testing was excellent. JetForm also offers the JetForm Server, which lets you automatically distribute different pages or multiple copies to different shared printers on a network. The program also has the ability to download the form to a PCL (Printer Control Language) printer as a macro so that only the data needs to be sent, which saves transmission time and can speed printing.

The program has some other weak points. For example, some functions of the Design program have keyboard shortcuts but are difficult to perform with a mouse, yet other tasks are easily done with a mouse but difficult or impossible to accomplish with the keyboard. Also, the automatic sequence of the form fields is governed in part by how far the field is from the top of the form; a slight misplacement can create a puzzling scramble of the field sequence.

This version of JetForm has many powerful and endearing features, but it is showing its age. According to JetForm representatives (and a brief demo of the work in progress on the new version), most of these shortcomings are addressed in the new version, along with the addition of many powerful new features. Yet the product we reviewed fails to hold its own against the newer programs included in this roundup. JetForm, Version 3.1, is a package whose time has come and gone.

► FACT FILE

JetForm, Version 3.1

JetForm Corp., Watermill Center, 800 South St., #305, Waltham, MA 02154, 800-538-3676, 617-647-7700; fax, 617-647-4121.

List price: *JetForm Design* (includes designer and one filler), \$495; *five-user version*, \$1,995; *JetForm Filler*, \$129; *JetForm for E-Mail: five-user version*, \$495; *JetForm Server* (20-user package), \$1,195.

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Microsoft Corp.

Microsoft Electronic Forms Designer

BY STEPHEN W. PLAIN

The \$395 Microsoft Electronic Forms Designer (EFD), Version 1.0, is not a self-contained forms package. It's a tool geared toward programmers familiar with the Microsoft Visual Basic (VB) programming environment. While EFD requires you to be proficient in Visual Basic, it provides unparalleled flexibility in developing workgroup solutions compared with packages we reviewed. Those organizations that are fully Microsoft Windows-based and have a Visual Basic programmer among their ranks will find EFD a natural evolutionary step.

EFD can work with cc:Mail and other MAPI-compliant products. However it's optimized for Microsoft Mail (MS Mail), and loses functionality under other e-mail systems. With MS Mail and Windows clients, EFD gives you the ability to create custom forms for MS Mail that are seamlessly presented to the user.

EFD is essentially a DLL that provides MAPI functionality and a set of sample Visual Basic projects that gives you a head start on developing your own creations. In addition to the standard MAPI functions such as MAPIAddress and MAPISendMail, EFD provides a set of 51 Microsoft electronic form functions designated with the prefix MEF for specific forms operations.

EFD works with either Visual Basic Professional Edition, Version 2.0 or 3.0, but the added database support in Version 3.0 is especially useful for complex forms development. VB 3.0 comes with the Microsoft Access, Version 1.1, database engine and connectivity to Btrieve, dBase IV, Foxpro, and Paradox databases, as well as ODBC (Open Database Connectivity) access to Microsoft SQL Server.

Installation of EFD is a straightfor-

ward process that requires only a few minutes. However, the setup program failed to prevent one basic problem that later hindered our testing. You can install the program to either a system equipped with VB for designing forms or to a series of directories on the file server. One of the directories created on the server supplies the VB runtime files necessary for an EFD form (which is actually a compiled VB program) to run.

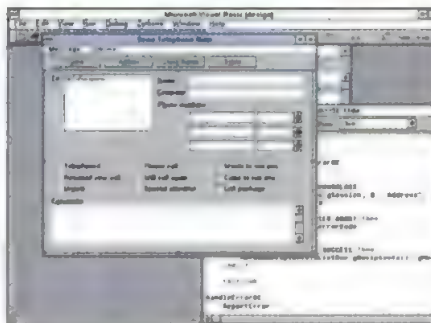
TWO PATHS

Once you create and compile forms in VB, there are two ways you can deploy them. A form can be placed on each local hard disk and declared in the user's MSMAIL.INI file, or it can be placed in a directory on the file server along with a SHARED.INI file that will make it accessible to any connected user. While the shared technique allows you to make forms immediately available to everyone, local installations are preferable in situations when you wish to work off-line. There are no associated runtime fees or extra modules required for distribution, regardless of which approach you choose.

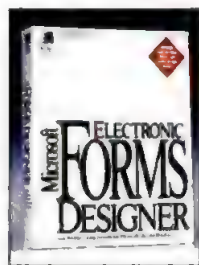
Since each EFD form is actually a complete VB program, the form can be compiled to an .EXE file for distribution. In order to test a form, you must have access to MS Mail, but if you use Windows for Workgroups on your PC, you can design and test

forms applications on a single machine. EFD takes advantage of MS Mail's custom message types to make the interaction between MS Mail and your custom form transparent.

EFD's real power lies in its ability to detect which information in a form should be routed and to move it automatically. When you design a form, you set the VB tag property for each data-entry field that contains information to be sent. Through various MEF calls, the program "packages" the tagged data and sends it along as an attachment to the message. On the recipient's end, the data is "unpacked" automatically by the form's code and presented to the user as a normal, filled-in form—no attachments to be opened manually.



Microsoft EFD comes with a telephone message sample that can be customized to your needs.



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CIRCLE 318 ON READER SERVICE CARD

Electronic Forms Software

SUITABILITY TO TASK				
Microsoft Electronic Forms Designer				
	POOR	FAIR	GOOD	EXCELLENT
Paper form design	N/A			
Electronic design	●	●	●	●
Fill-in/database linking	●	●	●	●
Transport/routing	●	●	○	○

Three VB projects are provided in the box: a Telephone Note sample, a Routing Form sample, and a generic template. The two samples are well chosen as they represent an application involving ad hoc addressing and one with predefined routing. You can either modify one of these sample projects to your liking or use the generic template to get started. Also available is the Microsoft Workgroup Templates (\$39), which are 13 prepackaged e-form templates for such applications as report consolidation, travel reservations, customer tracking, and service requests.

INTELLIGENT OPTIONS

We had no problem implementing most of our test script by making minor changes to the included templates. Because some of the fields in the sample examples were not relevant to our testing, we simply disabled them and turned off their visible properties. The customization of different copies of a multicopy form, however, required a bit of conditional coding to be attached to the form. But EFD wisely separates the Compose form from the Read form, which allowed us to customize the two operations to be quite different in implementation.

Noticeably absent from EFD is a means of producing high-quality printed output. The company's approach to forms is centered around on-screen workgroup computing rather than printed forms. You can, of course, use third-party tools such as Crystal Reports Pro (from Crystal Services) to produce your forms. If your requirements include security enhancements like electronic signatures, you'll have to turn to third-party tools.

FACT FILE

Microsoft Electronic Forms Designer, Version 1.0
Microsoft Corp., One Microsoft Way,

Redmond, WA 98052; 800-426-9400; fax, 206-936-7329.

List price: \$395 (includes runtime module); Visual Basic, Professional Edition, Version 3.0, \$495.

Circle 466 on reader service card

WordPerfect Corp.

WordPerfect InForms

BY GREG PASTRICK

With its powerful and versatile WordPerfect InForms, Version 1.0, WordPerfect Corp. has made an impressive debut in the electronic forms arena. The \$495 package (which includes a designer and filler) features easy-to-use design tools, strong links to external databases, conditional routing capabilities, editable object libraries, and electronic signatures. Yet with all that this product has going for it, you should still consider InForms a work in progress.

Among the features absent from this version are enhanced mail-handling functions, a macro language, and multiplatform support that matches what currently exists in WordPerfect Office, Version 4.0. Future releases of InForms promise these features, along with some optimization to improve its rather sluggish overall speed.

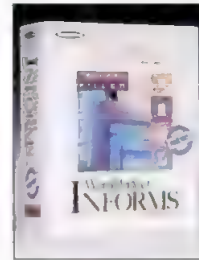
Installation of the Microsoft Windows-based InForms is complicated only by the fact that the designer and filler applications rely on WordPerfect Office to handle automated workflow and forms-routing routines. While InForms and Office are complimentary, the network installation and setup of each give you a very

real illustration of their complicated relations.

PICKING UP SPEED

The speed and responsiveness of the program during our testing slowed down to a crawl while creating multipage forms that were full of objects. This was especially true when we performed database linking and queries from network drives. Easily accessed tools for the creation of action buttons, pull-down lists, entry fields, radio buttons, bar codes, tables, and check boxes make up some for lost speed. So, too, do the built-in drawing and visual devices that shape, change, and edit the basic object attributes.

With a click of the mouse you can define, size, position, and assign calculations to each object on a form. You can also quickly build a full page of objects with a few click-and-drag motions. Plus,



complex objects can be named and saved to global or custom libraries for reuse in the design and creation of new forms.

It is really InForms' sophisticated database linking and query functions that show off the program's power. You can create new databases, establish links to existing ones, or

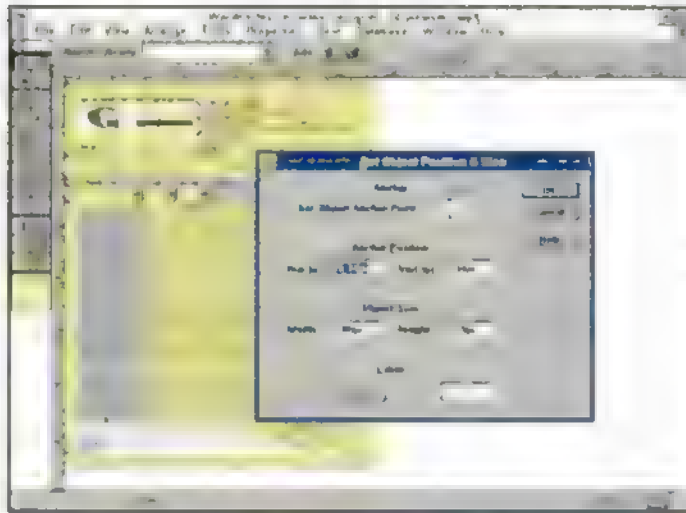
tie into multiple databases, including other linked forms. Not only can you seek and select records from defined fields, you can also store or print a report of the results of your query.

WordPerfect InForms has 120 built-in calculation functions that may be applied broadly to linked forms and databases or attached to objects and elements within objects (such as the cells in a table). Attribute, database, date-and-time, financial, statistical, system, text, and arithmetic variables expand the functions of the form by direct commands—such as assigning an @PRINT function to an action button—or as keywords in defining formulas.

Tools for creating a table on a form, however, were limited at best. In our testing, the cell-by-cell approach for the setup of repetitive operations was made even more tedious by the slow speed of the application under network operation (building smaller tables with fewer cells helps). Thankfully, the setup of complicated forms is complimented by the good documentation, numerous sample forms, and informative on-line help.

MAIL CALL

Electronically routing forms can be handled through the main menu or as a calculation function. For basic mail services, InForms supports VIM- and MAPI-based mail-messaging systems such as cc:Mail and Microsoft Mail. However, routing and other workflow abilities are not supported here (InForms relies on the external message transport to route forms). And although WordPerfect Office 4.0 has interfaces for DOS, the Macintosh, and Unix,



With a click of the mouse button, InForms allows you to change the size and position of each object on a form.

later this year.

Once the initial mailing list has been selected, the form has been attached to the message, and the message has been sent, WordPerfect Office takes over with its settings for notification and checkboxes for moving the message to the next recipient and finally back to the original sender. While WordPerfect Office handles these operations efficiently, future releases of InForms will optimize the existing mail and calculation functions. For now, you can build mail and messaging functions into calculations and conditional formulas to achieve a more defined response to form routings.

InForms provides two ways to mail forms electronically: as a form-transport file (a file containing a form and the information regarding the form's data-

InForms has only a Windows interface for its designer. At the time of our testing, the filler supported only Windows, although DOS support should be available by the time you read this and WordPerfect says Mac and Unix fillers are in the works for release

form will directly update the records in those database files.

Forms-transport files may be mailed with attached data as well. Recipients can edit and query database records to be updated by the appropriate source on the network without directly compromising the integrity of the established database. Regular forms can be opened with Designer or Filler, but only Filler can open transport files. When sent as attachments to e-mail, either file format can launch its respective application when you click on the attachment icon.

InForms is one of a few forms products we looked at that supports electronic-signature encryption and approved signoffs. Set up by the system administrator, electronic signatures may be tied to actions or functions that will ensure data integrity and security. We were impressed with InForms' security

features: You can assign approval rights not only to general database updates but to specific fields and objects as well.

InForms also shines in its hard-copy output: It deftly prints forms that match their on-screen appearance.

Printing is enhanced by setup options for downloading a single copy of a form to a printer and printing only data for multiple copies rather than multiple complete forms.

Like other products in our roundup, WordPerfect InForms requires a commitment from its users. It's a capable program, but if you want a full-featured forms designer and filler *and* routing and workflow capabilities, you had better be prepared to buy both InForms and WordPerfect Office 4.0. □

► FACT FILE

WordPerfect InForms, Version 1.0
WordPerfect Corp., 1555 N. Technology Way, Orem, UT 84057; 800-451-5151; fax, 801-228-5077.

List price: \$495 (includes designer and filler); additional filler, \$99 each (includes license only and no documentation); five-user version, \$1,425.

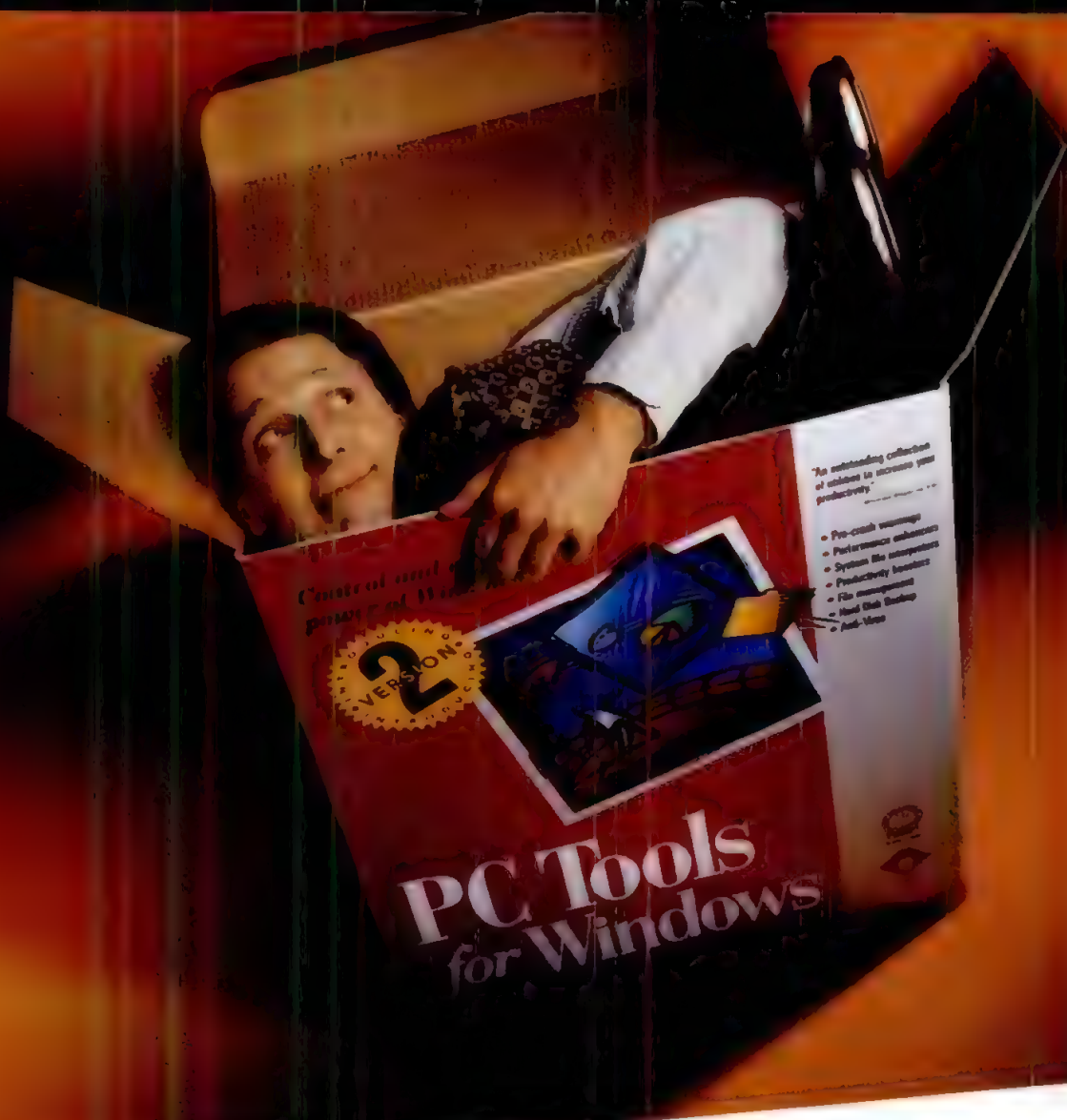
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It is really WordPerfect InForms' sophisticated database linking and query functions that show off the program's power.

SUITABILITY TO TASK				
WordPerfect InForms				
	POOR	FAIR	GOOD	EXCELLENT
Paper form design	●	●	●	○
Electronic design	●	●	●	●
Fill-in/database linking	●	●	●	●
Transport/routing	●	●	●	○

base links) or as the form with links to the database, which is usually located on the server. Provided you (or all mail recipients) have access to the same drives and directories where linked databases are stored, any data entered in a

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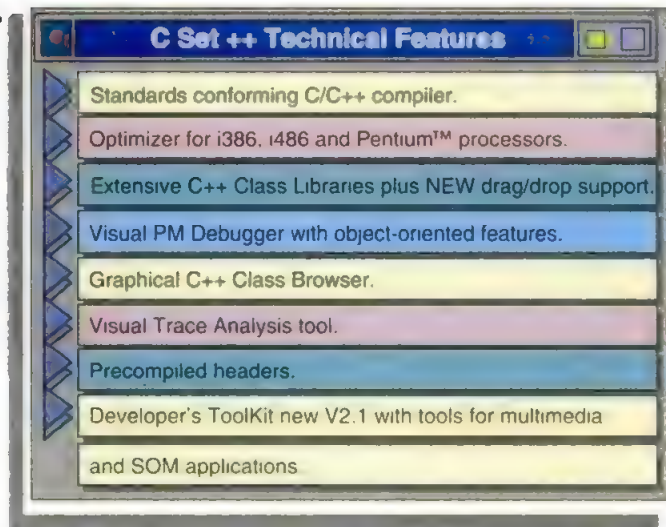
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Plus!

With GUI development now on center stage, powerful IDEs, application frameworks, and code generators are as important as the compilers themselves.



C++ New Package, New Power

By Sheryl Canter

Is it just coincidence? In the closing weeks of 1993, almost within days of one another, Borland International, Microsoft Corp., and Symantec Corp. all launched major new revisions of their C++ compilers. Clearly, there's more involved than chance. Programming for graphical operating environments—especially for Microsoft Windows 3.1—has quickly moved from a niche position to the mainstream of software development. And after the release of Chicago—Windows 4.0—later this year, GUI development should

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become overwhelmingly dominant. In making the shift from character-based environments, programmers have found that GUI-development woes can be significantly eased by tools such as code generators and application frameworks, not supplied by traditional compilers.

Vendors are racing to deliver these tools, hoping to win the hearts and minds of C++ programmers for the future. The stakes are high; companies that stumble now can expect little programmer loyalty down the road.

Here we cover the latest GUI-oriented generation of PC-based C++ compilers. Given the trend toward graphical environments, we tested only compilers that could generate code for either Microsoft Windows NT, Windows 3.1, or IBM OS/2 2.x. Interestingly, this did not exclude any commercial PC-based C++ compiler known to us (excepting Unix compilers, which we did not review). Performance testing covered character-mode and graphical code generation in DOS, Windows NT, Windows 3.1, and OS/2 2.1.

GUI: THE WINNING TECHNOLOGY

Not surprisingly, the most visible trend in this year's C++ compiler roundup is the move toward Windows- and OS/2-hosted development environments. When we last reviewed C++ compilers (July 1992), IDEs

(integrated development environments) were already well established, but none were hosted in a graphical environment. Since then, the major players—Borland, IBM, Microsoft, and Symantec—have all launched integrated toolsets that run under Windows NT, Windows, or OS/2.

To be sure, command line-driven compilers from smaller vendors are still available, and some offer special features not found in the products of larger companies. But most of these niche vendors also have plans to move their products to a GUI host, usually Windows. The fact is unmistakable: Graphical development environments are the winning technology.

Another clear trend is the increased importance of application frameworks—C++ libraries that encapsulate key elements of the Windows or OS/2 C API. Application frameworks help ease development by shielding the programmer from the API's formidable complexities. For Windows developers, the choice is essentially between Borland's ObjectWindows Library (OWL) and the increasingly dominant Microsoft Foundation Classes (MFC), also licensed by Symantec.

Closely related are the sophisticated code generators now found in all three leading Windows-hosted C++ compilers. This trend was started by Microsoft, the company that arguably holds the current

lead. For example, in Microsoft Visual C++, Version 1.5, OLE 2.0 code-generation options turn a former programming nightmare into a simple check-box option.

PERFORMANCE

Compiler performance issues are far from dead, however, and there have been some surprising upsets. In its latest incarnation, Borland C++, historically one of the fastest compilers, was narrowly beaten by Visual C++ 1.5 and Symantec C++ Professional, Version 6.1, on most of our compile-speed tests.

While compiler speed is a big sanity factor during software development, the performance and size of executable code are vital for the finished product. This is an area where the command line compilers we tested more than held their own. These products are all from smaller companies that have focused their attentions on sophisticated optimizations.

For example, the fastest executables created during testing came from Watcom C/C++³², Version 9.5, while the 16-bit version of the same compiler produced the smallest executables. There is always some trade-off between compile speed and the quality of generated code, so using these optimizing compilers makes the most sense late in your development cycle.

The other big news in the C/C++ compiler market? That there's no news in DOS-development tools. None of the vendors here have significantly changed or enhanced the DOS sides of their products. Symantec C++ still lacks a DOS graphics library, and neither the Borland nor the 16-bit Microsoft compiler offers a DOS extender. If C/C++ compilers are any indication, DOS's days are numbered.

BUNDLE OF TOOLS

It used to be that when you bought a C compiler, that's all you got. Today's bundles include compilers and hosts of other programming tools, typically a programmer's editor, a Windows resource editor, various spy utilities for monitoring Windows messages, a class browser, a debugger, a code-generation tool, and a linker. Each is a full-featured program in its own right. Today, the best mainstream C++ compiler is the one that offers the best toolset along with a fast, efficient, and bug-free optimizing compiler.

HIGHLIGHTS

C++ Compilers

IDES ARE HOT. An IDE brings a wealth of tools into a single GUI workspace: code and resource editors, compilers, debugging tools, project management tools, and on-line help. IDEs are also the home of "wizards" and "experts," intuitive code generators that can automate some of the most complex and repetitive coding tasks.

BUT DON'T OVERLOOK the traditional command line compilers. They may look like dinosaurs next to their GUI-based competitors, but they often deliver the tightest, fastest-running code available. Optimization can exact a penalty in

slow compile times, so using these tools makes the most sense late in the development cycle. Command line compilers offer code-generation expertise that can make your final product shine.

WINDOWS C++ PROGRAMMING is never easy, but application frameworks mean you don't have to reinvent the wheel. These C++ classes encapsulate large parts of the Windows C API, shielding you from its complexity. They can also help you dish up standard interface objects and widgets. Used with wizards or experts, they can generate working prototype applications.

Which operating environments a compiler can target may also be a major consideration. Here, Borland C++, Version 4.0, stands out with its support for DOS, Windows NT, Win16, and Win32s applications. At the other end of the spectrum, Visual C++ 1.5 targets only two environments: 16-bit DOS and Win16. Among the niche compilers, you may find support for more esoteric targets—Watcom C/C++³²'s support for NetWare Loadable Modules, for example.

THE DEVELOPMENT ENVIRONMENT

IDEs provide a workbench from which you can access the many programming tools that come with a compiler. Key features are an integrated editor and a debugger. You edit your source code from within the environment, and then when you compile it, error and warning messages appear in a separate window, keyed to the source code in the editor. Clicking on an error or warning message will move the cursor within the editor to the relevant line.

With an integrated debugger, you can also set breakpoints within the editor and perform other debugging tasks without having to launch a separate program. Many vendors are making IDEs the centerpieces of their products' environments.

Documentation is extremely important, especially the on-line documentation for products with IDEs. There are reams of information to cover: API documentation, use of the development environment and tools, syntax for the C and C++ languages, switches, options, error messages, and more. Borland's documentation shines in this area, with some of the best explanations of basic concepts.

Both Visual C++ compilers offer a new twist on documentation: The products are available only on CD-ROM, and their documentation is entirely electronic; printed manuals are an additional purchase. IBM also distributes only electron-



EDITORS' CHOICE

• Microsoft Visual C++

The story of how we finally decided on an Editors' Choice selection comes down to a tale of two compilers: Borland C++, Version 4.0, and Microsoft Visual C++, Version 1.5. Both products offer excellent features, but their very different strengths will be relevant

for very different types of development.

Ultimately, the nod went to Visual C++ 1.5, a development tool representing a great advance over Microsoft's past efforts in this area. Our choice acknowledges the increasing dominance of Windows development and stems from two of Visual C++ 1.5's strengths: The MFC 2.5—the de facto Windows application framework standard—and the product's advanced code generators, such as the OLE 2.0 option in its AppWizard and ClassWizard. Visual C++ 1.5 also showed highly competitive performance, both in compile speed and quality of executable code.

Visual C++ 1.5 does have its downsides, though. The language implementation lacks templates and C++ exception handling, the IDE has awkward features, and a separate product

(Microsoft Visual C++ 32-Bit Edition, Version 1.0) is required for Win32 and Win32s development. Even so, Visual C++ 1.5 represents today's best option for mainstream Windows development.

An honorable mention goes to Borland 4.0. Although it's no longer the fastest C++ compiler around, this product offers a highly intuitive IDE; the ability to target DOS, Win16, Win32, and Win32s platforms straight out of the box; and a strong C++ language implementation. Support for DOS programming is exceptional. But Borland's ObjectWindows Library 2.0 lacks the OLE 2.0 and ODBC support that the MFC offers, and Borland's Experts are not as compelling as Microsoft's Wizards. With Version 4.0, Borland has also lost its performance lead, both in compile speeds and code execution.

ic documentation with the CD-ROM version of IBM C Set ++ for OS/2.

EVOLVING LANGUAGE

The other major arena for competition among compiler vendors is C++ language implementation itself. There is still no ANSI standard for C++, but Version 3.0 of the AT&T C-front compiler defines the working standard.

Two important C++ innovations haven't yet found their ways into all of the

reviewed compilers. One is templates, type-independent function descriptions that can be instantiated with particular data types. The other is C++ exception handling, a sophisticated method for error handling that replaces the `setjmp()` and `longjmp()` routines used in standard C.

Templates are supported by all the compilers in this lineup, except for Clarion TopSpeed C++ and the two Visual C++ compilers. The only products that provide exception handling are Borland 4.0, C Set ++ for OS/2, and both versions of Watcom C/C++.

All the compilers here offer varying degrees of support for GUI development, and many still strongly support traditional character-mode programming. Whatever your focus, the reviews that follow will help you sort through the multitude of features these complex products offer.

Our Contributors: SHERYL CANTER is a contributing editor and RICHARD V. DRAGAN is a programmer at *PC Magazine*. REX CONN is an independent software developer and the author of the command-processor replacements 4DOS and 4OS2. BRADLEY EPRANIAN is a free-lance technical consultant and programmer. NANCY NICOLAISEN teaches computer science and is president of N² Software Engineering, a consulting firm. THOMAS E. SIERING has managed and developed numerous major commercial software packages. THOMAS MACE was the associate editor in charge of this story, and JAY MUNRO was the project leader.

Borland International Inc.

Borland C++

Borland C++ for OS/2

BY RICHARD V. DRAGAN

Borland International's newly released Borland C++, Version 4.0, represents a significant upgrade to its popular C++ compiler for DOS, Microsoft Windows, and Microsoft Windows NT. This impressive package boasts ObjectWindows Library (OWL) 2.0, a C++ application framework geared toward cross-platform development. It also sports a very attractive set of tools centered on a powerful IDE.

Borland 4.0 delivers state-of-the-art support for C++ features like templates and structured exception handling, and it offers an advanced approach to managing projects. While Borland no longer builds the fastest C++ compiler around, this product's strengths are formidable.

In the OS/2-development arena, last year's first release of Borland C++ for OS/2 brought programmers an able and robust C++ compiler that took much of the sting out of writing OS/2 2.x character-mode and Workplace Shell/Presentation Manager applications. A major new release of Borland C++ for OS/2, which we were unable to preview for this story, is expected to appear soon after you read this. Version 1.0 is briefly discussed at the end of this review.

INTEGRATED CENTERPIECE

The centerpiece of Borland 4.0 is its IDE, used to create DOS executables and 16-bit and 32-bit Windows executables. The IDE's smooth multiple-document interface lets you split source files into multiple panes or tile open files both vertically and horizontally. Comprehensive on-line help on the Windows API is always just a key-stroke away, and a master index lets you search the numerous on-line help files at once and provides cross-references to the printed manuals.

Although very powerful and usable right out of the box, the IDE is also highly customizable. The code editor offers remappable keys and supports Brief and Epsilon emulation. You can also add any

Suitability to Task: C++ Compilers

In rating these C++ compilers, we presumed that your target operating-system platform or API will be the most basic factor driving your choice. Though some of the products are specialized for single platforms, others offer developers a broad cross-platform reach.

Prototyping and fast application development indicates how easily a package lets you go from scratch to a working application. A product's interface-design tools and code-generation features are important, as are application frameworks and other class libraries. Important features include "wizards" or "experts" that can generate a skeleton application, well-integrated editing and debugging tools, and on-line, thorough documentation.

To judge **Windows development**, we examine the quality of each package's application framework, resource editor, Windows debugger, and spy tools for monitoring Windows messages. The depth of other Windows-specific features—especially "wizard" or "expert" code generators—weighs heavily. Speed and size of generated code are also factors.

of your favorite tools to the environment and invoke them directly from within the IDE menu. Syntax highlighting is supported, and you can set the color of each highlighted element and add your own tokens.

Stylesheets that let you manage and maintain any combination of compiler and build options represent another advanced IDE feature. Default stylesheets are provided for program speed or size optimization, or for generating debug information. You can combine styles or create new ones with your own compiler and linker options.

Stylesheets are used in conjunction with the revamped Project window, which offers support for multiplatform targets. The Project window is organized in a

SUITABILITY TO TASK				
Product Name				
	POOR	FAIR	GOOD	EXCELLENT
Prototyping and fast application development	●	○	○	○
Windows development	●	●	○	○
DOS development	●	●	●	○
OS/2 development	●	●	●	●
Windows NT development	N/A			

N/A—Not applicable. The target platform is not supported.

Remember DOS? With our **DOS development** task, we evaluate how well each compiler remembers. Does it offer an integrated debugger for DOS? A DOS user-interface library? A class browser? Is 32-bit extended-DOS technology provided? Again, we consider the size and speed of the code each compiler generates.

The ratings in **OS/2 development** and **Windows NT development** indicate how well a compiler exploits the advanced features of these operating systems. A multithreaded IDE is an asset, as is a debugger that can handle threads. Is the development environment hosted on the target platform so you can test your application? Are substantial class libraries or application frameworks provided for the target environment?

graphical hierarchy of nodes consisting of source and target files. With the Target-Expert feature, you can configure target file options for DOS programs, 16-bit and 32-bit Windows .EXEs, and DLLs; more than one type of .EXE target can appear in the Project window. This feature acts as a graphical MAKE file; files that depend on other files appear farther down the hierarchy. For purists, text MAKE files can be generated automatically for a project at any time.

Once you've built your application, the IDE supports Windows-ident debugging for DOS applications, and 16-bit and 32-bit Win32s Windows applications. You can set breakpoints, set watchpoints, and trace your code from within Windows. Although the IDE does

SUITABILITY TO TASK				
Borland C++, Version 4.0				
	POOR	FAIR	GOOD	EXCELLENT
Prototyping and fast application development	●	●	●	●
Windows development	●	●	●	○
DOS development	●	●	●	●
OS/2 development	N/A			
Windows NT development	●	●	●	○

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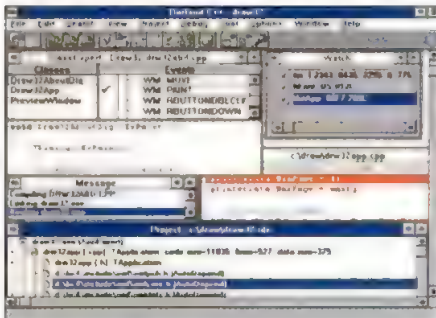
not support background compilation, you can run compile reliably while tasking out to another Windows application.

OWL: WORTHY RIVAL

OWL 2.0 is the cornerstone of Borland's Windows-development strategy. Today, OWL 2.0 provides immediate binary source-code compatibility for both 16-bit Windows and single-threaded 32-bit Win32s programs. Borland and Novell's recently announced ObjectWindows for AppWare (scheduled for release this summer) should extend OWL's reach to a variety of environments, including Macintosh, OS/2, and Unix.

OWL 2.0 is a worthy rival of the Microsoft Foundation Classes (MFC). It offers a thorough set of C++ classes that both encapsulate the functionality of the 16-bit and Win32s Windows APIs and provide higher-level user-interface objects like toolbars and bitmap gadgets. OWL 2.0 also offers built-in exception handling, so even if you choose not to implement C++ structured exception handling in your own code, you can safely use OWL 2.0, which does.

Much like the MFC, OWL 2.0 now includes support for GDI (Graphics Device Interface) drawing functions of the Windows API that are centered around objects for device contexts. But OWL 2.0 adds one important safety enhancement called GDI object orphan control. Normally, if you forget to delete GDI brushes or pens—or if you delete them while they are still selected into a Windows device context—you will erode GDI resources, eventually bringing down the system. With orphan control in OWL 2.0, however, an encapsulated class for a



Borland 4.0 offers a powerful and customizable IDE for building DOS, Win16, and Win32 .EXEs.

FACT FILE

Borland C++, Version 4.0 Borland C++ for OS/2

Borland International Inc., 100 Borland Way, Scotts Valley, CA 95066-3249;
800-331-0877, 408-431-1000



List price: Version 4.0, \$499, OS/2 version, \$495

Requires: 386-based PC or better, 4MB RAM, 75MB hard disk space (full installation), DOS 4.01 or later, Microsoft Windows 3.1, or OS/2 2.x

In short: Although it's no longer the fastest compiler on the market, Borland C++, Version 4.0, is so feature-rich and easy-to-use that many developers will find it an irresistible choice for developing DOS, Microsoft Windows NT, and Windows 3.1 applications. Borland's OWL 2.0 application framework offers a true alternative to the Microsoft Foundation Classes. For OS/2 developers, a major revision of Borland C++ for OS/2 is expected soon after this article appears. We expect the new release to strengthen this already able product considerably.

451 (IN READER SERVICE CARD)

device context in Windows restores the default GDI drawing objects before it's deleted.

Borland 4.0's AppExpert is an indispensable code generator for OWL programming. A welcome time-saver, it creates a working shell application, complete with a menu, a toolbar, a single- or multiple-document interface, and print-preview capabilities, much like a default MFC program. The Class-Expert lets you add code selectively to

event-handler routines that service particular Windows messages. You can also add your own objects derived from OWL classes. Like the MFC, OWL 2.0 uses a document/view model for managing application data. The document/view model allows document sharing in OLE 2.0, for instance, and the links between applications can be encapsulated in C++ code.

32-BIT NOW, OLE NEXT

Borland 4.0 does not offer OLE 2.0 support, but Borland has promised to release soon an update that does. An additional tool, the DialogExpert, automates the creation of new dialog boxes from within the IDE. The dialogs can then be further customized using the Resource Workshop.

The Resource Workshop works automatically to maintain resource identifiers for menus, icons, and bitmaps, which can be linked directly to your ObjectWindows code. As with earlier releases, the Resource Workshop is an easy-to-navigate, MDI application that lets you open and edit several resources at once. One useful new feature here is the ability to preview resources such as bitmaps before opening them. Dialog-box design is a crucial element of writing Windows programs, and the Resource Workshop supports vanilla Windows controls, the Borland Custom Controls, and the Microsoft 3-D Controls, as well as third-party Visual Basic VBX controls. Additional Windows-centric tools include WinSight, a Windows message spy, and WinSpecter, a postmortem debugging tool that logs GP (general protection) and other critical faults.

For 32-bit Windows development, the Borland 4.0 IDE runs under Win32s (which ships with the product), so you can create and debug 32-bit Win32s applications using the same target and

host. For developers who work exclusively under NT, there are 32-bit command line tools that work under NT, which provide faster build times than you get in the 16-bit environment.

As an additional

strength for NT development, the standard class libraries in Borland 4.0 include classes for threads and mutex objects, which will simplify writing multithreaded applications. And the 32-bit Turbo Debugger for Windows offers single-monitor, multithreaded debugging, whether you use the 32-bit command line tools or work from within the 16-bit IDE.

Borland's traditional support of the

SUITABILITY TO TASK

Borland C++ for OS/2

	POOR	FAIR	GOOD	EXCELLENT
Prototyping and fast application development	●	●	○	○
Windows development	N/A			
DOS development	N/A			
OS/2 development	●	●	●	●
Windows NT development	N/A			

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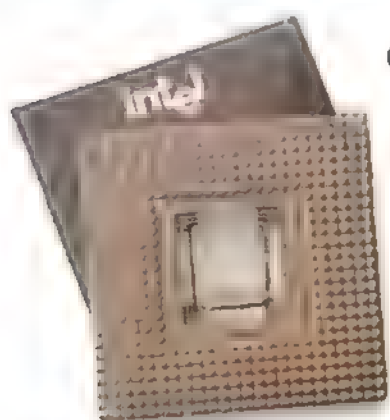


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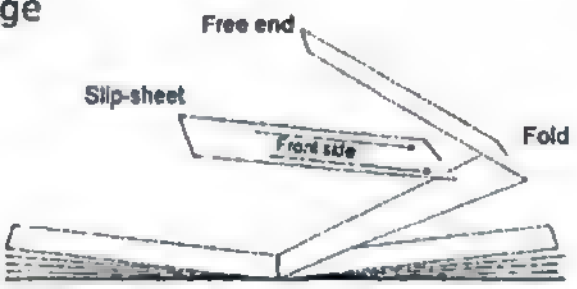
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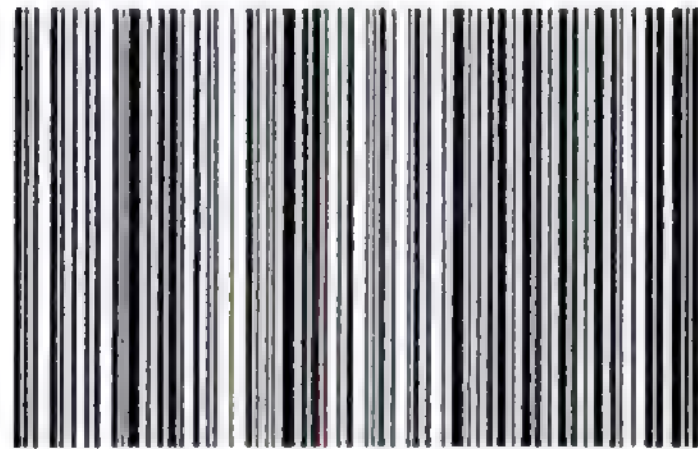
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4. Close the page and slip-sheet



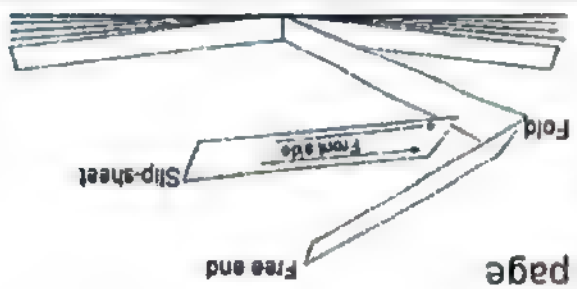
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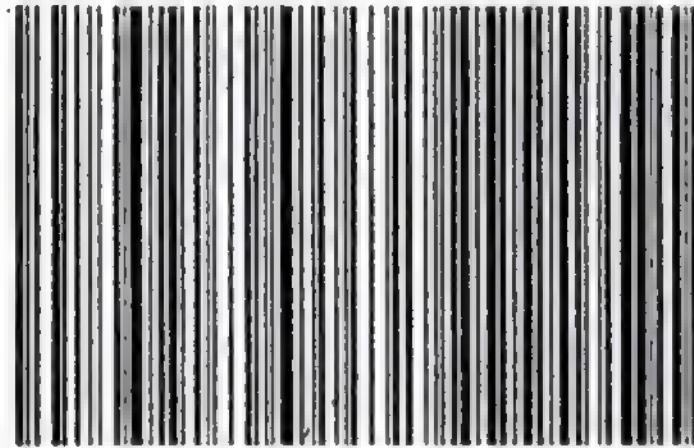
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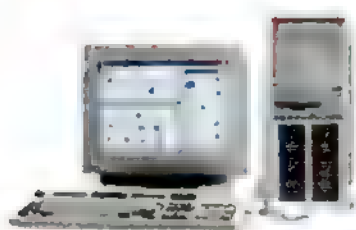
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latest C++ standards continues. Besides supporting AT&T 3.0 (including its templates, which are used throughout the product's class libraries), Borland 4.0 also supports the latest proposed ANSI standards for structured exception handling. It also supports runtime type information, which allows type-checking information to be included in your executable. Although our tests showed that Borland's compiler was no longer the speed and size champion, many developers will agree that it is still the most robust implementation of C++ available in a PC compiler.

OS/2 DEVELOPMENT

While an upcoming release of Borland C++ for OS/2 promises to enhance the abilities of the original 1.0 release, the latter is nonetheless an easy-to-use package with a sturdy IDE. It lacks certain features, such as a C++ application framework, but it does provide the standard C++ classes for containers and a full implementation of C++ iostreams. Borland C++ for OS/2 supports C++ templates but not structured exception handling.

Although Borland C++ for OS/2 lags behind Borland's Windows package, it still shines in the bare-bones world of OS/2 2.x programming. During testing, it was actually faster than IBM C Set ++ for OS/2, with arguably a prettier face. We expect the new release to strengthen this already able product considerably.

Clarion Software Corp.

Clarion TopSpeed C++

BY BRADLEY EPRANIAN

Clarion TopSpeed C++, Version 3.1, is a compiler with plenty of history behind it. Impressive milestones include its use of both the first smart-linking technology and an extensible, open-architecture IDE that accepts plug-in compiler modules for other languages.

But TopSpeed (\$379) seems to be living in the past. The character-based IDE badly needs a face-lift, and the performance of this compiled code was comparatively slow. The 16-bit-only compiler covers 16-bit DOS and Microsoft Windows, and it also targets several very interesting niche environments, including

FACT FILE

Clarion TopSpeed C++, Version 3.1

Clarion Software Corp., 150 E. Sample Rd.,
Pompano Beach, FL 33064; 800-354-4444,
305-785-4555; fax, 305-946-1650



List price: \$379

Requires: 386-based PC or better, 640K RAM, 4MB hard disk space, DOS 3.1 or later

In short: A niche product with a loyal following, Clarion TopSpeed C++ is a good choice if you need

to develop multithreaded applications, DLLs, or C++ extensions to the Clarion Database Developer language. Middling code performance and slow compile and link times can be forgiven if producing tight code is a prime requirement. TopSpeed provides a DOS-based IDE, which integrates a number of its tools. For mainstream developers, however, this product's drawbacks outweigh its advantages. We look forward to a future release to turn the situation around.

ON READER SERVICE CARD

multithreaded DOS applications and DOS, OS/2 1.x, and Windows DLLs. At the same time, it is poorly positioned for mainstream development. A new Windows-hosted product, slated for release later this year, should steer TopSpeed back into the race.

EXTENSIBLE IDE

The DOS-hosted, text-based IDE looks old-fashioned next to its Windows-hosted rivals, but it offers the basics: access to the code editor, compiler, and debugger. The IDE menu is extensible, so you can add options to launch any third-party program. More important, the IDE provides an open architecture that lets you add other Clarion compilers, such as the company's Modula-2 and Pascal products. All underlying compilers and linkers are smoothly integrated using Clarion's own DOS-based DLL technology.

On-line help in the IDE is available but not ample. Library functions are documented, and by placing your cursor on a function and pressing F1, you can access help for that particular function. You cannot directly reference language calls such as #pragma or #include, however.

The help system is also extensible, so if you've added any Clarion compilers to the IDE, you automatically have access to their on-line help. Unfortunately, you can't copy code examples from the help files to paste into your own programs.

The printed documentation is generally hard to use and somewhat short on clarity. The reference sections lack depth, and cross-referencing among manuals is nonexistent. Some of the explanations are good, but the overall quality is uneven.

A FEW STRONG SUITS

TopSpeed's strongest suit is its power as an extension tool for Clarion-language database development. While other C compilers can be used to create routines to be called from the Clarion Database Developer, the link process can be difficult. TopSpeed eases the process, because it automatically matches the calling conventions of the C runtime libraries used in Clarion.

The company plans to expand on the product's database orientation in future versions. Class libraries for most major databases are under development, and the next TopSpeed release should provide easy access to Brievie, Clarion, Clipper, CTree, dBASE, FoxPro, ODBC

(Open Database Connectivity), and Paradox.

Another unique feature is TopSpeed's support for creating multi-threaded DOS applications. These can be run in real mode, or in protected mode using the company's proprietary 16-bit

DOS extender (a \$99 add-on). Multi-threaded DOS applications can even be run in a Windows DOS box. This capability can be used for anything from porting OS/2 application to DOS to creating communications programs that monitor multi-

SUITABILITY TO TASK

Clarion TopSpeed C++, Version 3.1

	POOR	FAIR	GOOD	EXCELLENT
Prototyping and fast application development	●	○	○	○
Windows development	●	●	○	○
DOS development	●	●	○	○
OS/2 development	N/A			
Windows NT development	N/A			

ple serial ports.

Multiprocess scheduling is handled by a Clarion-developed, interrupt-driven time scheduler. The scheduler takes over the timer interrupt for time-slicing threads within programs. TopSpeed supports both OS/2 and proprietary process handling, and both are relatively easy to implement using simple commands like StartProcess, StartScheduler, and Wait.

TopSpeed also supports the development of Windows and 16-bit OS/2 DLLs, and Clarion has even devised a way for running OS/2-style DLLs under DOS. DOS DLLs offer an interesting means for developers to upgrade program functionality without having to distribute entirely new executables.

TopSpeed provides debugging support for both DLL types. The text-based debugger has good functionality, and, with minor tweaking, DLLs can be easily converted among the DOS, Windows, and OS/2 environments using a command line switch.

The product ships with all the standard AT&T 2.1 C++ classes. Additional libraries (including communications and a simple database) are Modula-2-based but can be called just as you would call a standard C function. There's also a multithreading class library.

Windows development options are strictly limited, since the product lacks an application framework, a resource editor, and a help compiler. You can run third-party compilers from the IDE, but there is no support for third-party tools. There is also no in-line assembler, no optimization support for 386 processors or better, and no support for precompiled headers. The product's C++ language implementation does not support templates or C++ exception handling.

SPEED TESTS

TopSpeed's tested compile-and-link speed fell into the middle range. The resulting code proved to be quite compact; when compiling our C++ test code, TopSpeed turned in the tightest executable of

the bunch. The credit for this performance goes to TopSpeed's linker, a strong tool that can remove the unused portions of C++ virtual base classes, C++'s greatest overhead compared with C.

Code execution speed was another matter, however. Here, the results were the slowest by a substantial margin. Unless code size is paramount, this trade-off represents a significant drawback.

Compiler warning levels are configurable according to the type of warnings

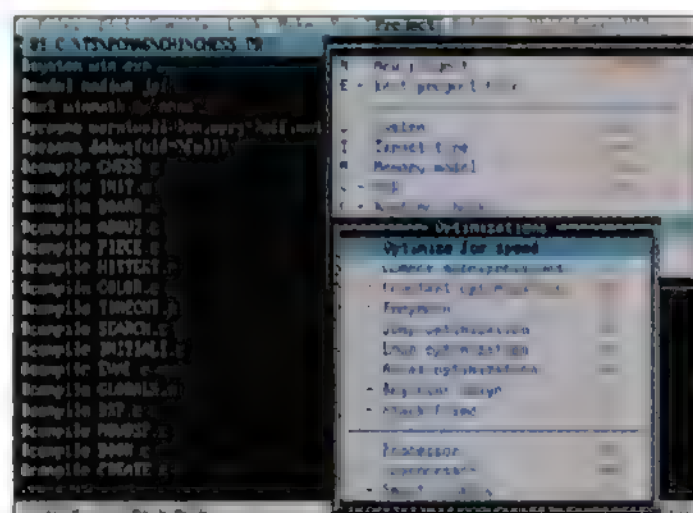
you wish to view or suppress. Warnings can be set at three levels: Off, On, and Error. The Error setting can even be used to halt compilation on certain warnings.

The text-based installation system is unnecessarily confusing. If you insert the wrong disk, the program simply returns an

error rather than prompting you for the right one. It also prompts you to insert the environment disk first long after you've installed the environment. The company is currently revising the installation process.

WAIT FOR THE NEXT ONE

TopSpeed boasts some real if esoteric strengths. It is a strong extension tool for Clarion database development, and its multithreading and DLL support offer unique solutions for niche applications. But unless you can leverage any of these special abilities, this is a hard product to recommend. The next release will show if Clarion's past legacy of impressive technical know-how can be translated into a productive mainstream tool.



TopSpeed's character-based IDE lets you plug in other Clarion compilers.

IBM Software Solutions

IBM C Set ++ for OS/2

BY THOMAS E. SIERING

Developing software for a complex and sophisticated operating environment such as OS/2 requires a significant suite of tools, as well as comprehensive, technical-information resources. IBM C Set++ for OS/2, Version 2.1, represents a successful attempt at meeting most of these needs in a single package.

COMPLEX TOOLSET

A survey of the major components in this large and complex toolset begins with WorkFrame/2, an integrated development environment (IDE) implemented as an extension to the OS/2 Workplace Shell. The C/C++ Tools component consists of a C/C++ compiler, a programmer's editor, class libraries for Presentation Manager (PM) programming and a variety of other development tasks, a PM-hosted source-level debugger, an execution trace analyzer, a source-code browser, sample programs, and comprehensive on-line documentation and tutorials.

The Developer's Toolkit for OS/2 supplies miscellaneous utilities, reference materials, and sample code. Finally, the Multimedia Presentation Manager Toolkit/2 covers OS/2's multimedia aspects with tools, reference information, and sample programs. These IBM-developed components are augmented by KASE:Set, a user-interface development and prototyping package from Kaseworks.

The CD-ROM edition of C Set ++ contains no printed documentation, while the disk version includes a set of introductory manuals. All documents are included on-line in both editions.

UNDER THE HOOD

You can use one of two different versions of the WorkFrame/2 IDE, depending on a project's size. Version 2.1 is intended for large projects that may require multiple source directories. Version 1.1 is specifically designed as a simpler environment for small- and medium-size efforts. The IDE allows convenient integration of additional software and fits the OS/2 user-interface paradigms very comfortably.

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Our testing produced surprises, as traditionally fast products fell behind former slowpokes. Command line tools offered the slowest compile speeds but cranked out the fastest code.

How We Tested

Our performance tests used three source-code applications chosen for their portability and independence from proprietary compiler or class-library optimizations. Representatives of all vendors came to PC Magazine Labs to participate in the product testing. The vendors, in conjunction with PC Labs, ported our test programs to the tested compilers.

XSCHEME, a public-domain character-based Scheme-language interpreter written by David Michael Betz, served as a representative large C project in

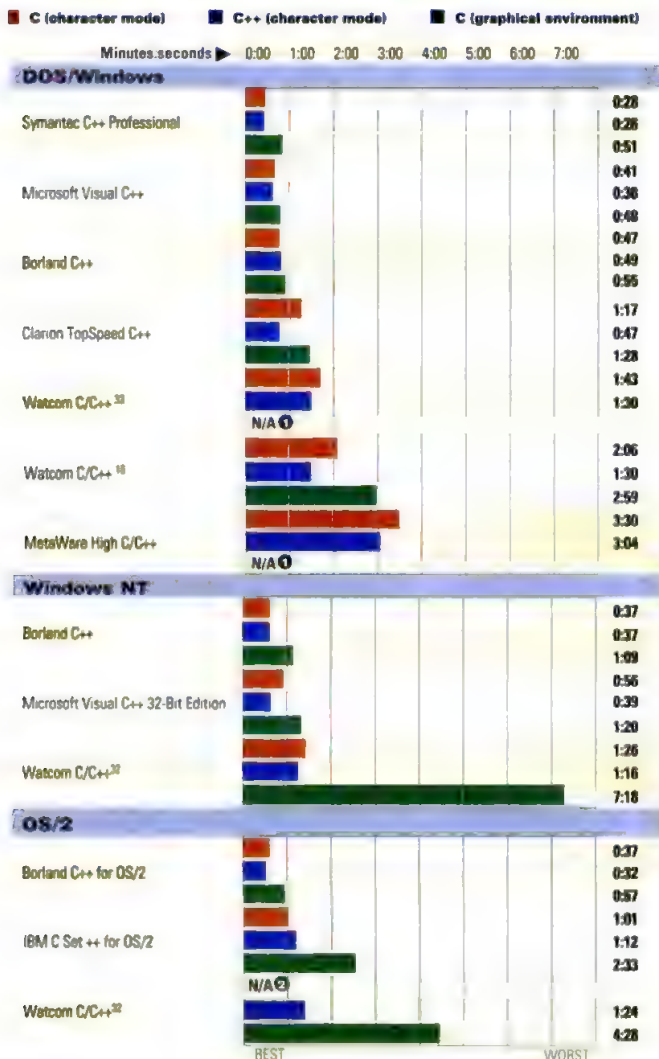
testing. We used the program, which is made up of 16 C source files and 5 header files, to measure the compile times and execution speeds. XSCHEME results are labeled *C (character mode)*.

We used CPPBENCH as our C++ test program, a synthetic benchmark test written using Rogue Wave class libraries. CPPBENCH runs through a series of calculations and is self-timing. CPPBENCH results are labeled *C++ (character mode)*.

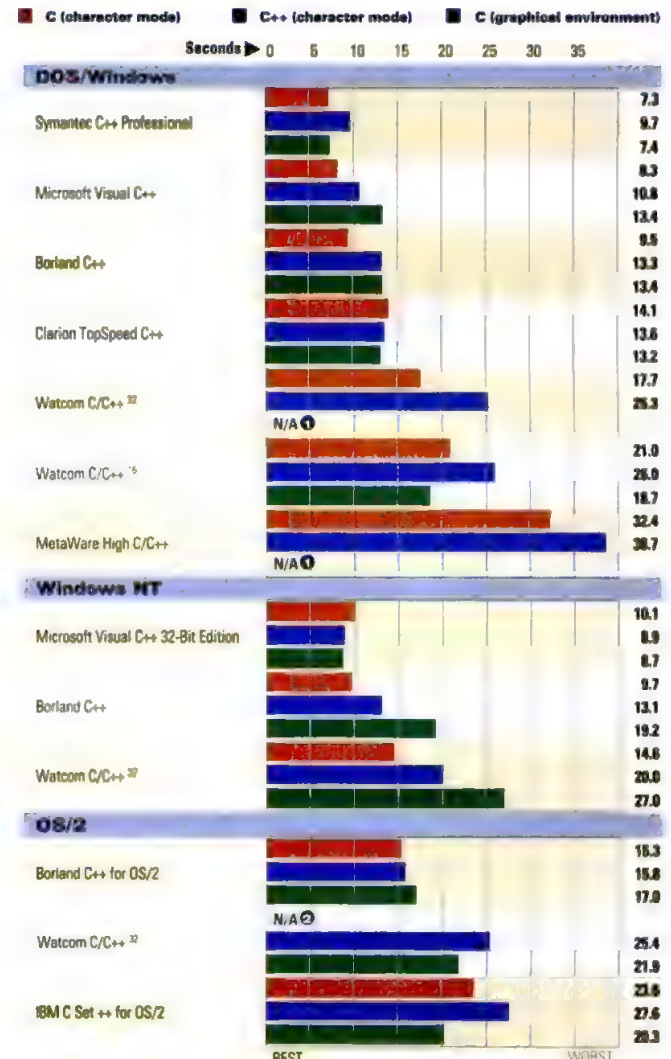
To test GUI program generation, we used The Free Software Foundation's GNU Chess, a public-domain chess game that uses standard Windows API calls instead of a proprietary application framework. For OS/2 and Windows NT testing, we used ported versions of GNU Chess from IBM and Microsoft. We did not use GNU Chess to test execution speed. GNU Chess results are labeled *C (graphical environment)*.

Our test-bed was a Compaq Deskpro 486/33M with 16MB of RAM. Our operating systems were DOS 6.2, OS/2 2.1, Windows NT, and Windows 3.1. We timed command line builds by using the TIM utility supplied by Microsoft. We timed IDE builds with a stopwatch.

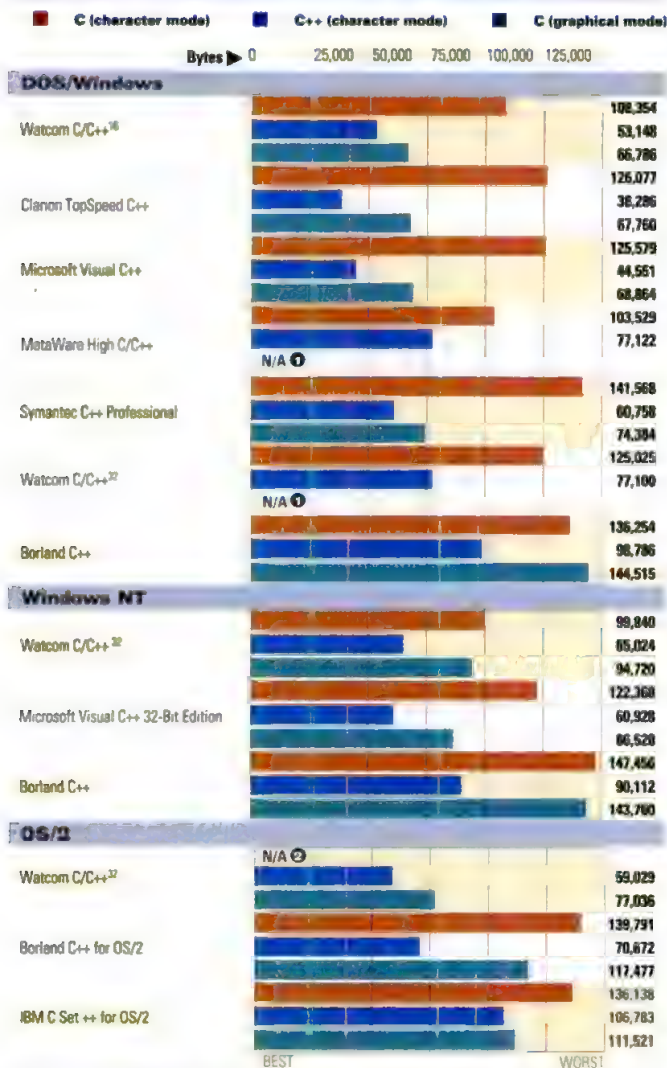
COMMAND LINE FULL-DEBUG BUILD



COMMAND LINE PARTIAL-DEBUG BUILD



EXECUTABLE SIZE

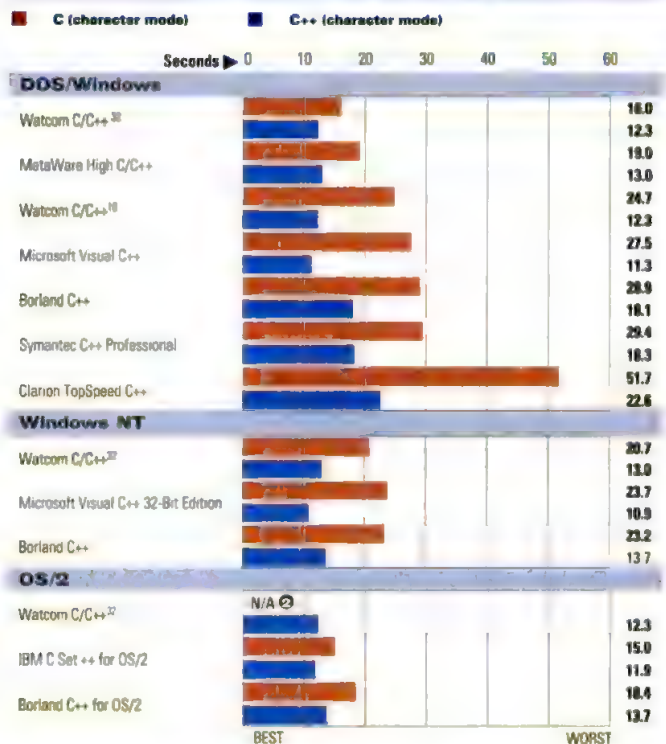


N/A—Not applicable. Our Windows test program cannot be compiled in this product's extended 32-bit DOS environment.
N/A—Not applicable. The source code for this test could not be ported to the target platform in time for this story.

We rebooted the tested systems between compile operations. We disabled SmartDrive write caching on the DOS/Windows platform. Microsoft requested a 512K RAM disk as a target for temporary files, so we offered this option to other vendors. While this option doubled some performance scores for Microsoft Visual C++ 1.5, its effect was negligible for the other products.

Because performance testing requires a standardized platform, we could not always test products using the vendor's recommended environment. Microsoft felt that Visual C++ 1.5 was unfairly penalized by the reboot we required between partial builds (when compiling after a reboot, Visual C++ 1.5 initializes a compiler server, causing a delay of about 5 seconds). Also, Microsoft believes most users disable map-file generation and enable SmartDrive write caching. When we tested Visual C++ 1.5 with these recommended parameters, its IDE Partial-Debug Build score improved by as much as 60 percent. Apart from the 512K RAM disk, Microsoft's recommended optimizations are not reflected in the published results.

EXECUTABLE SPEED



N/A—Not applicable. The source code for this test could not be ported to the target platform in time for this story.

THE TESTS

The accompanying graphs show the products' results on the six tests described below. Each reported result represents an average score based on several test repetitions. Products are shown ordered from best to worst, based on the mean of all three test-application scores.

Command Line Full-Debug Build This test involves a full build of all source modules into an executable, starting from a freshly booted environment with all selectable compiler optimizations turned off and full debug information and map-file generation enabled. We disable error reporting or set it to the lowest level.

Command Line Partial-Debug Build This scenario involves deleting the existing executable and largest object module and performing a new build. We reboot systems between timings.

IDE Full-Debug Build This test mirrors the Command Line Full-Debug Build test, but for IDE-based products only. Each score indicates the time it took for the screen to return after the menu item or button was pushed.

IDE Partial-Debug Build This test mirrors the Command Line Partial-Debug Build test, but for IDE-based products only. Each score indicates the time it took for the screen to return after the menu item or button was pushed.

Executable Size To generate the executables for the size test, we enable available compiler optimizations for executable size. We do not time the build speed.

Executable Speed This test uses only two source-file bases: XSCHME and CPPBENCH. XSCHME generates timings by interpreting a script, and CPPBENCH times its own execution internally. We enable any available compile-speed optimizations.

—Analysis written by Jay Munro

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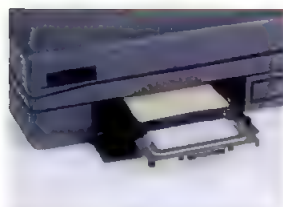
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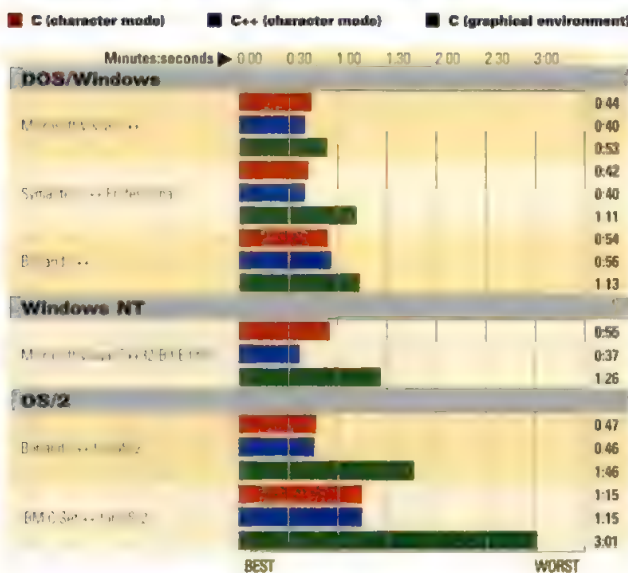
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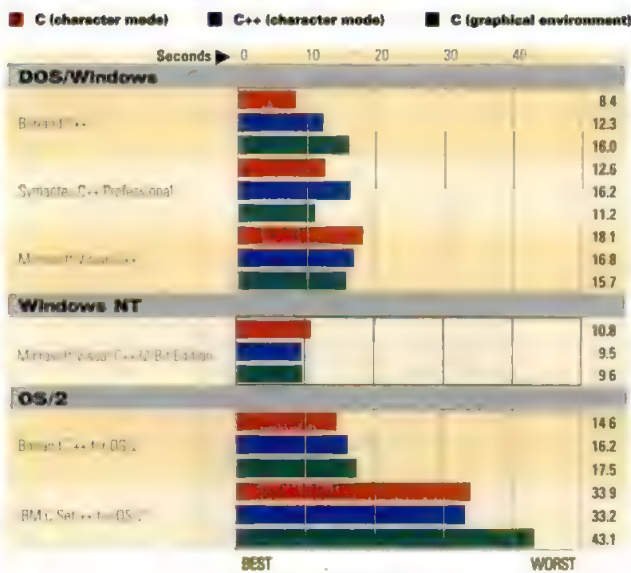
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CIRCLE 012 ON READER SERVICE CARD

IDE FULL-DEBUG BUILD



IDE PARTIAL-DEBUG BUILD



An interactive tutorial guides you through setting up a development project using the object-file library manager and MAKE-file generator. Since the details of MAKE-file setup are hidden, correcting any errors interactively can be difficult, and even the tutorial doesn't guarantee instant success. But once set up, projects can be managed very intuitively, and you can employ object-action associations among files and the tools used for manipulating them.

The editor is a central element of the development environment. Its tight integration makes for very convenient code-editing and subsequent use of other tools. But like many editors bundled with compilers, this one is fairly basic and unspectacular. Obvious improvements would include better help facilities and key-stroke templates for emulating popular

editors. Fortunately, the C Set ++ editor can be easily replaced.

Debugging facilities are impressive. The debugger is a fully integrated PM application. It allows visual debugging of multithreaded applications and includes facilities dealing with PM specifics, such as a window-analysis feature and a message-queue monitor. Additionally, features such as exception handling and templates are specifically supported. The debugger has a clean and intuitive user interface and includes help and a tutorial.

Profiling is handled by the Execution Trace Analyzer. Support for analysis of multithread interreactions is provided. This is particularly helpful for observing events leading to deadlocks.

Viewing, analyzing, and navigating source code and displaying relationships among source elements are important concerns. To handle this, you can set C Set ++ to update a browser database whenever you execute a compile. This information can be filtered by browsing selected parts of the source code and may

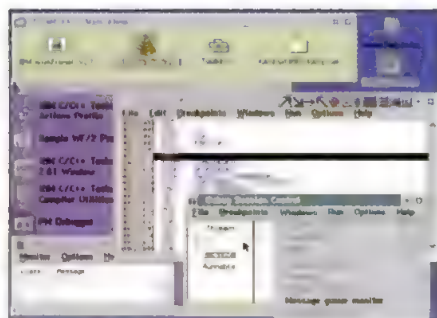
be displayed in three formats. An alphabetical list shows selected symbolic components of a software project. Alternatively, graphs can be drawn to demonstrate visually the structural relationships among program components. Finally, Text Format is useful for viewing and editing logical relationships, such as the implementation of a class. This well-documented utility is a very useful and powerful tool.

Writing GUI applications typically involves large amounts of fairly repetitive coding to handle common tasks. To keep you from having to reinvent the wheel, IBM bundles a copy of KASE:Set with C Set ++. This product presents a subset of KASE:VIP, a \$1,495 graphical development tool for client/server applications. The included version covers the areas of window, menu, panel, and notebook design. It generates both C code using the PM API library and C++ code utilizing the IBM User Interface Class Library. The resulting code can be manually changed as required. The product monitors your design for compliance with

SUITABILITY TO TASK

IBM C Set ++ for OS/2, Version 2.1

	POOR	FAIR	GOOD	EXCELLENT
Prototyping and fast application development	●	●	●	○
Windows development	N/A			
DOS development	N/A			
OS/2 development	●	●	●	○
Windows NT development	N/A			



The powerful debugger in C Set ++ is a fully integrated PM application.



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Sound Blaster 16 ASP	Yes	Yes	CD-ROM	No	\$149.95
ProAudio Spectrum-16	Yes	No	SCSI	No	\$299.00

*Base SRP



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C++ Compilers

FACT FILE

**IBM C Set ++ for OS/2,
Version 2.1**

IBM Software Solutions, 844 Don Mills
Rd., North York, Ontario M3C1H7;
800-342-6672



List price: \$595

Requires: 386-based PC or better, 12MB RAM, 75MB hard disk space (full installation), OS/2 2.x or later; 16MB RAM, Super VGA, OS/2 2.1 recommended

In short: For professional OS/2

developers, this comprehensive suite of OS/2-development tools is a strong contender. This large and complex toolset includes the WorkFrame/2 IDE, implemented as an extension to the OS/2 Workplace Shell, a C++ compiler, a programmer's editor, class libraries for Presentation Manager (PM) programming, a PM-hosted source-level debugger, an execution trace analyzer, a source-code browser, and sample programs. Slow compiler performance is offset by the reasonably speedy code the product generates

459 ON READER SERVICE CARD

IBM's 1991 Common User Access user interface design guidelines.

Three graphical resource editors are available for dialog, font, and icon design. All of them are attractive and easy to use, and all provide the capabilities found in comparable products. You can create on-line manuals and help systems to complement software using the Information Presentation Facility.

LIBRARY FACILITIES

Other than utilities, the greatest single asset for software development consists of code libraries. Complementing the customary C library functions are some useful extras such as debugging functions for memory management problems and support for the mathematical concepts of Infinity and Not-a-Number (NaN). The Standard Class Library addresses three major areas: complex math support, C++ standard iostream classes, and support for coroutines. The Collection Classes include ubiquitous data structures, such as sets and trees.

The most visible component is the IBM User Interface Class Library. Comprising a total of 260 classes and 2,600 member functions, this library offers an object-ori-

ented approach to building OS/2 applications. Rather than requiring you to write code to handle every detail of a program, these classes provide default behaviors that can be modified or overridden as required. Also implemented are advanced features such as drag-and-drop.

C Set ++ conforms to the AT&T 3.0 standard and implements catch/throw exception handling and templates. In-line assembly, a common nonstandard extension, is unavailable, however. But the compiler can compile in the background, allow for header precompilation, and perform the common optimizations for 386, 486, and Pentium processors. As its test results show, C Set ++ sacrifices build speed for reasonably well-optimized code. For a production-quality compiler, this can certainly be considered a reasonable trade-off.

Newcomers to OS/2 may find this package fairly opaque. Developers covering multiple platforms will also find it very OS/2-centric, since it lacks an application framework and development tools for cross-platform work. But for any serious OS/2 developer, the solid professional tools of C Set ++ are a must.

MetaWare Inc.

MetaWare High C/C++

BY BRADLEY EPRANIAN

While other compilers offer honed, elegant IDEs, MetaWare High C/C++, Version 3.1, remains a plain command line holdout. But don't be fooled by appearances. For certain types of specialized 32-bit code generation, this niche product offers impressive technology that is well worth considering.

LIMITED PLATFORMS

The number of platforms that High C/C++ targets is strictly limited. The basic product (\$795) is designed for building 32-bit Windows 3.1 executables using the bundled MetaWare Application Development Kit (ADK). It can also compile NetWare Loadable Modules (NLMs). An extend-

ed-DOS version of High C/C++ (\$995) supports 32-bit protected-mode DOS development. High C/C++ does not support any 16-bit targets.

If these platforms match your needs, the performance of compiled code is excellent. High C/C++ scored second from the top on our executable-speed tests. This high level of optimization comes at the expense of compile speed, however: High C/C++'s scores in this area were the lowest of any product in our lineup. Executable size, however, was reasonable thanks to the compiler's virtual base-class optimization switch.

We caught High C/C++ right before a major revision. MetaWare plans to enhance the product with a 32-bit Microsoft Windows NT compiler, a 32-bit OS/2 compiler, and support for C++ exception handling. The new version should appear soon after you read this article. A Windows-hosted IDE and support for multiplatform debugging are planned for future releases.

32-BIT DEVELOPMENT

High C++ makes 32-bit windows development possible via the ADK application framework, MetaWare's optimized library extension of the Windows API. The ADK also provides a 32-bit translation layer that runs on top of Windows 3.1 for running 32-bit Windows applications.

Two protected-mode debuggers are supplied, one capable of handling 32-bit Windows applications and the other capable of handling protected-mode DOS

code. DLL debugging is not supported.

The version of the product intended for 32-bit extended-DOS development includes Phar Lap Software's well-known 386/DOS-Extender SDK. It also includes a large Phar Lap library of

functionality, including real- and protected-mode swap areas, large memory allocation, and DOS call traps. For general development, the Rogue Wave Tools.h++ 6.0 library is also a significant addition to the product. With the included NLM com-

SUITABILITY TO TASK**MetaWare High C/C++,
Version 3.1**

	POOR	FAIR	GOOD	EXCELLENT
Prototyping and fast application development	●	●	○	○
Windows development	●	●	○	○
DOS development	●	●	○	○
OS/2 development	N/A			
Windows NT development	N/A			

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► SUMMARY OF FEATURES

C++ Compilers

PC MAGAZINE
EDITORS' CHOICE

Products listed in alphabetical order

■ = YES □ = NO

	Borland C++	Borland C++ for OS/2	Clarion TopSpeed C++	IBM C Set ++ for OS/2	MetaWare High C/C++	Microsoft Visual C++	Microsoft Visual C++ 32-Bit Edition
List price	\$499.00	\$495.00	\$379.00	\$595.00	\$795.00	\$599.00	\$599.00
Compiler Features							
Size/speed optimization	■ ■	■ ■	■ ■	□ ■	■ ■	■ ■	■ ■
Pentium, 486, 386 optimization	■ ■ ■	■ ■ ■	□ □ ■	■ ■ ■	■ ■ ■ □	■ ■ ■	■ ■ ■
Precompiled headers	■	■	□	■	□	■	■
In-line/standalone assembler	■ □	■ ■	□ □	□ □	■ □	■ □	■ □
Background compiling	■	■	□	■	■	■	■
Platforms supported (host/target)							
DOS16	■ ■	□ □	■ ■	□ □	□ □	■ ■	□ □
DOS32	□ □	□ □	■ ■	□ □	■ ■	□ □	■ ■
Microsoft Windows 3.1	■ ■	□ □	□ ■	□ □	□ ■ (32-bit)	■ ■	□ □
Microsoft Windows NT	□ ■	□ □	□ □	□ □	□ □	■ □	■ ■
Win32s	□ ■	□ □	□ □	□ □	□ □	□ □	□ ■
OS/2 2.x	□ □	■ ■	□ □	■ ■	□ □	□ □	□ □
In-line user function	■	■	■	■	■	■	■
Templates	■	■	□	■	■	□	□
C++ exception handling	■	□	□	■	□	□	□
Nested types	■	■	■	■	■	■	■
Editor							
Remappable keys	■	■	■	■	N/A①	□	□
Color-coded keywords	■	■	□	□	N/A①	■	■
On-line documentation	Full	Partial	Partial	Full	None	Full	Full
Development Environment							
Context-sensitive help	■	■	■	■	N/A①	■	■
Wizards, experts, or equivalent	■	□	□	■	N/A①	■	■
Cut-and-paste samples from on-line help	■	■	□	■	N/A①	■	■
User can customize and save desktop	■	■	■	■	N/A①	■	■
Third-party program launch	■	■	■	■	N/A①	■	■
Desktop drag-and-drop	■	■	□	■	N/A①	■	■
User-defined menus	■	■	■	■	N/A①	■	■
Integrated debugger	■	■	□	■	N/A①	■	■
Version-control hooks	□	□	□	■	N/A①	■	■
Programming Tools							
Class browser	■	□	□	■	□	■	■
Profiler	□	□	■	■	■	■	■
Windows or OS/2 programming							
Resource compiler	■	■	■	■	□	■	■
Help compiler	■	■	□	■	□	■	■
Resource editor	■	■	□	■	□	■	■
Application-framework classes	OWL	None	None	IBM User Interface Class Library	ADK	MFC 2.5	MFC 2.0
Debugging Features							
Debugging target:							
Windows 3.x, Windows NT, Win32s	■ ■ ■	N/A②	□ □ □	N/A②	■ □ □	■ □ □	□ ■ ■
DOS16, DOS32	■ □	N/A②	■ □	N/A②	■ ■ □	■ ■ □	□ ■
OS/2 2.x	□	■	□	■	□	□	□
.EXE or DLL browser	■	■	□	■	□	■	■
Message spy	■	■	□	■	□	■	■
DDE spy	■	□	□	□	□	■	■
Miscellaneous							
Program memory-management options:							
32-bit DOS extender	□	N/A②	□	N/A②	□	□	■
Creates program overlays	■	N/A②	■	N/A②	□	■	N/A②
32-bit flat memory	■	■	□	■	■	□	■
Runtime checks							
Array-boundary checking	□	□	■	□	□	□	□
Numerical-range overflow	□	□	■	■	□	□	□
Null pointers	□	□	■	□	□	■	■
Stack overflow	■	■	■	■	□	■	■
Classes and libraries							
OLE 2.0	□	N/A②	□	N/A②	□	■	□
VBX control access	■	N/A②	□	N/A②	□	■	N/A②

N/A①—Not applicable. The product does not have this feature. N/A②—Not applicable. The product's host environment does not support this feature.

C++ Compilers

pilers and linker, High C/C++ offers one of the few available options for NLM development. An NLM debugger will not be available until the next release, however.

High C/C++ currently provides a compiler switch for Pentium, 486, and 386 optimization. MetaWare has also put extensive work into floating-point optimizations in terms of both emulation and support for math coprocessors. According to the company, the Pentium optimizations boost performance through improved handling of floating-point manipulations, simple math, and memory moves.

You can select three compiler error/warning-message levels. At the highest level, the compiler alerts you to numerous bug-inducing conditions, including NULL pointer assignments and uninitialized pointers. It also handles bounds checking and assignment in conditional statements, helping ensure stable code. At the lowest error/warning level, you can get around strict C++ type casting. While this might be considered unsafe functionality, this can ease the transition between C and C++ and provide some useful work-around options.

Although High C/C++ lacks an IDE, it can be run under many of the IDEs currently shipped by other compiler manufacturers. The product does include a simple DOS-based text editor called EC. It supports remappable keys, but none of the other High C/C++ tools can be launched from within it.

INSTALLATION & DOCUMENTATION

The product's installation routine is decidedly bare-bones. A completed installation under Windows simply exits to the File Manager without creating icons or a program group; it's not even clear whether the product has successfully installed itself. DOS installation dumps you at the command prompt without even offering access to a READ.ME file. The documentation explains the installation process clearly, however. A total installation takes up only 11MB of disk space, a fraction of what many other compilers gobble up.

The supplied documentation, of good overall quality, includes a programmer's manual, a language reference, debugger manuals, quick reference guides, and the

Windows ADK manual. The full documentation for the included Rogue Wave library is also provided.

Excellent on-line help is available via command line queries, and all of the programming examples from Charles Petzold's *Programming Windows 3.1* are included. MetaWare offers excellent support through voice, fax, e-mail, or its BBS at no charge.

COMING ATTRACTIONS

The next revision of High C/C++ is expected in the second quarter of this year. In addition to releasing 32-bit Windows NT and IBM OS/2 compilers, the company is planning to make its Windows NT C++ compiler compatible with the Microsoft Foundation Classes and the tools included with Microsoft Visual C++ 32-Bit Edition. With the advent of the Windows NT compiler, the ADK will be phased out.

This release will also include a client/server NLM debugger to utilize fully the NLM development capabilities of the existing compiler. Other significant new features will be support for C++ exception handling and a SOM (System Object Model) compiler switch.

FACT FILE

MetaWare High C/C++,
Version 3.1

MetaWare Inc., 2161 Delaware Ave., Santa Cruz, CA 95060-5706; 408-429-6382; fax, 408-429-9273

List price: \$599

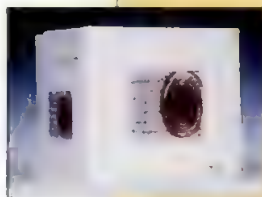
Requires: 386-based PC or better, 4MB RAM, 11MB hard disk space, DOS 3.1 or later

In short: A bug-free, stable platform, MetaWare High C/C++ is a good choice for generating 32-bit

Windows and 32-bit extended-DOS applications as well as NetWare Loadable Modules. This is a specialty compiler that supports 32-bit targets only via a 32-bit translation layer for Microsoft Windows 3.1 or Phar Lap Software's 32-bit DOS extender. The package produces tight code with fast execution speeds, and the documentation is strong. A major revision, due soon after we go to press, will add 32-bit Microsoft Windows NT and OS/2 development to the fold.



ON-READER SERVICE CARD



C++ Compilers

In future releases, MetaWare will provide a multiplatform debugger, which will run under protected-mode DOS, OS/2, Windows NT, Windows 3.1, and a variety of Unix implementations.

INTO THE MAINSTREAM

As one of the first companies to ship a 32-bit compiler and offer 486 and Pentium optimization, MetaWare can boast an impressive track record. The company has also had a long time to hone its product, resulting in a highly stable, bug-free compiler.

If you are interested in any of High C/C++'s specialized targets but want to wait for the new release, MetaWare offers free upgrades for 90 days after purchase; upgrades cost \$195 thereafter. You can upgrade from any previous version for \$295, and maintenance releases are always free.

It's hard to envision High C/C++ as a developer's tool of first resort. But its ability to create nicely performing 32-bit executables that run in extended versions of 16-bit environments ensures it a solid position in the C++ field. We look to the next release to bring this product more squarely into the mainstream.

Microsoft Corp.

Microsoft Visual C++ Microsoft Visual C++ 32-Bit Edition

BY SHERYL CANTER
AND REX CONN

If you think Visual C++ is just a pretty face on top of Microsoft Corp.'s old, slow C++ compiler, think again. Microsoft Visual C++, Version 1.5, beats much of the competition in compile speed—even Borland C++, which has historically been much faster. It also produces small, fast executables that rival those of optimizing command line compilers. A companion product, Microsoft Visual C++ 32-Bit Edition,

Version 1.0, brings the same environment, performance, and most of the same tools to Microsoft Windows NT development.

Both versions are loaded with productivity enhancers that can drastically shorten development time. These include code-generating wizards and an outstanding, visually oriented resource editor. Visual C++ 1.5 isn't the best tool for DOS development, and the 32-bit edition doesn't even

support it, but both products outstrip the competition in Microsoft Windows and Windows NT development.

VISUAL WORKBENCH

Visual Workbench is the integrated development environment for both versions. It combines a source-code editor, resource editor (App Studio), source-code browser,

debugger, a tool for generating the basic Windows program framework (AppWizard), a tool for automating common Windows programming tasks (ClassWizard), and extensive on-line help. Visual C++ 1.5 also includes wizards for creating OLE 2.0 and ODBC (Open Database Connectivity) applications. The wizards generate C++ code that uses the Microsoft Foundation Classes (MFC).

Like most development environments, Visual Workbench is project-oriented. You tell the project manager which source files belong to your application and it will build an internal project MAKE file by scanning each file for dependencies. The project MAKE files are in NMAKE format and can be used from the command line if you choose. You can also use MAKE files that you write yourself from within Visual Workbench, but then you must maintain the MAKE files manually.

Unfortunately, you can't add non-C/C++ files to the internal project files. If your program uses modules written in other languages, such as assembler, you'll have to either use external MAKE files or assemble the files in a separate step and then add the .OBJ files to your project.

The one weak part of Visual Workbench is the file editor, which was lifted

from the old Microsoft Quick C for Windows and is much less powerful than the editor included with Microsoft C/C++, Version 7.0. It has color syntax highlighting and an integrated debugger, but it's missing things you'd expect in a serious programming editor—such as programmability and macro support. You'll want to keep your favorite editor handy for the heavy-duty tasks. Visual Workbench makes this easy by letting you add your editor to the Tools menu.

The resource editor, App Studio, is one of the best parts of Visual Workbench. It handles virtually any resource, and its visual design makes it very intuitive to use. Menu creation is particularly well designed, and the multilevel undo feature lets you easily correct mistakes.

The C++ compilers in both versions are fast—much faster than the compilers in their Microsoft predecessors. Both produce small, fast-executing programs, and both can optimize code for Intel processors up to the 486. The 32-bit edition adds

SUITABILITY TO TASK

Microsoft Visual C++,
Version 1.5

	POOR	FAIR	GOOD	EXCELLENT
Prototyping and fast application development	●	●	●	●
Windows development	●	●	●	●
DOS development	●	●	○	○
OS/2 development	N/A			
Windows NT development	N/A			

FACT FILE

Microsoft Visual C++,
Version 1.5Microsoft Visual C++ 32-Bit
Edition, Version 1.0

Microsoft Corp., One Microsoft Way,
Redmond, WA 98052; 800-426-9400, 206-
882-8080; fax, 206-936-7329

List price: \$599 each

Requires: Version 1.5: 386-based PC or better, 8MB RAM (12MB recommended), 80MB hard disk space (full installation), CD-ROM drive, DOS 5.0 or later, Microsoft Windows 3.1. 32-Bit

Edition: 486-based PC or better, 16MB RAM (20MB recommended), 80MB hard disk space (full installation), CD-ROM drive, Microsoft Windows NT

In short: For either Windows 3.1 or Windows NT programming, you won't find better productivity tools than those found in the Visual C++ products. Their superb resource editors and code-generating wizards take much of the tedium out of GUI program development, significantly shortening development time. Their DOS tools, however, are less well developed. In sum, these products give Microsoft a commanding position in the C++ compiler market

461 ON READER SERVICE CARD

Pentium processor optimization.

Unfortunately, both products still lag in C++ syntax; Microsoft has not yet added template support or C++ exception handling, though both are planned for the next release.

NEW IN VERSION 1.5

The most important new feature in Visual C++ 1.5 is support for OLE 2.0 and ODBC. The OLE 2.0 SDK and key portions of the ODBC SDK now ship with the product. Also, the MFC 2.5 and Visual Workbench wizards have been enhanced to support both OLE 2.0 and ODBC.

OLE 2.0 is central to Microsoft's larger operating system strategy. The company's vision is for OLE to be routinely incorporated into Windows applications. But the OLE 2.0 specification is extremely complex and still evolving. The MFC 2.5 now provides a buffer between the programmer and OLE 2.0 details. The task is made easier still by the new OLE options within ClassWizard and AppWizard. The ClassWizard has also been redesigned with index tabs to make it easier to use.

Microsoft added ODBC support to Visual C++ 1.5 for those who want to add external databases to their applications. ODBC provides a single API for accessing data in any format; all you need is the appropriate driver. Drivers for Access, Btrieve, dBase, Excel, FoxPro, Oracle Server, Paradox, SQL Server, and text files are provided with the product.

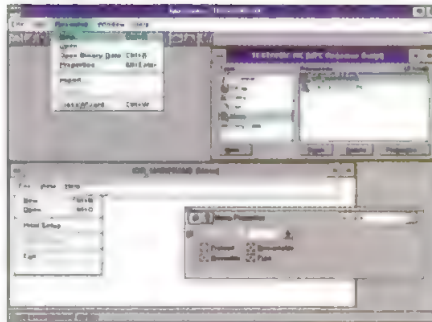
Although the other additions to Visual C++ 1.5 are minor, one in particular will be welcomed by many programmers: The product can now be run under Windows NT. You can also run the command line version of the compiler from OS/2 if you change your DPMS_DOS_API setting to "enabled" and your DPMS_MEMORY_LIMIT to 10MB; no patches are needed.

Another change is that Visual C++ 1.5 now comes only on CD, and printed manuals cost extra (\$99 for each documentation set). The CD provides the complete Visual

C++ 1.5 and SDK manuals, accessible through a search engine.

NEW 32-BIT EDITION

The 32-bit edition can create Win32 NT and Win32s applications. Only the Intel platform is currently supported, but Microsoft is working on versions for



App Studio offers working prototypes to make menu design especially intuitive.

MIPS and the DEC Alpha.

Like Visual C++ 1.5, the 32-bit edition is built around the Visual Workbench, but it also has command line tools if you prefer them. These are built with Phar Lap Software's TNT, so you can run the command line compiler from DOS. TNT Lite, a stripped down version of TNT, ships with the product and lets you create your own Windows NT console applications that also run under DOS. (TNT Lite also ships with Visual C++ 1.5.)

Since the 32-bit edition ships with the MFC 2.0, it doesn't include the MFC 2.5's support for OLE 2.0 or

ODBC, and it also lacks classes to support Windows NT-specific features such as multiple threads, processes, and RPCs (remote procedure calls). The MFC 2.5 wasn't included with the product because OLE 2.0 and ODBC are still

in beta on Windows NT. A re-entrant version of the MFC is in the works, so Windows NT programmers will be able to use the MFC on more than one thread.

Although the MFC 2.0 supports Visual Basic custom controls, you can't use them with the 32-bit edition because they are

inherently 16-bit. Microsoft eventually plans to migrate to 32-bit OLE 2.0 custom controls across its product line, but these won't be available for some time.

The debugger in the 32-bit edition is very similar to the integrated debugger in Visual C++ 1.5, but it has been enhanced with support for multithreaded debugging, Windows NT-structured exception handling, and a window for viewing memory. Unlike Visual C++ 1.5, which comes with CodeView in addition to the integrated debugger, this version does not have a standalone debugger, and Microsoft doesn't plan on adding one. Microsoft's plan is to continue enhancing the integrated debugger. The Spy utility provided with Visual C++ 1.5 is useful for tracking messages going to a window, but you have to decode the message parameters manually. In the 32-bit edition, Spy has been replaced with Spy++ which, in addition to showing the message-stream information, displays the fully decoded parameters for each message and other valuable information about windows, processes, and threads.

The 32-bit edition's profiler, like the one that comes with Visual C++ 1.5, lets you analyze your programs based on function timing, function count, function sampling, function coverage, line count, and line coverage. Though both are command line programs, the Windows NT version ships with a utility accessible from the Debug menu that lets you choose profiler options from within a dialog box, making it much easier to use.

COMMANDING POSITION

Both versions of Visual C++ boast excellent on-line help that's thorough and extensively cross-indexed. A particularly convenient feature is the language syntax help, which you can bring up by simply placing the cursor on a keyword and pressing F1. The on-line manuals are also useful, though a hard-copy manual would be more convenient for the tutorial.

Both Visual C++ products give Microsoft a commanding position in the C++ compiler market. They're not the best choices for DOS programming, but if you're writing programs for Windows or Windows NT, you'll be hard-pressed to find development systems with more or better productivity tools.

SUITABILITY TO TASK				
Microsoft Visual C++ 32-Bit Edition, Version 1.0				
	POOR	FAIR	GOOD	EXCELLENT
Prototyping and fast application development	●	●	●	●
Windows development	N/A			
DOS development	N/A			
OS/2 development	N/A			
Windows NT development	●	●	●	●

Symantec Corp.

Symantec C++ Professional

BY SHERYL CANTER

Symantec C++ Professional, Version 6.1, integrates a suite of high-quality development tools into a very innovative development environment based on the powerful MultiScope debugger. Appearing just three months after the initial release of Symantec C++ (which replaced Zortech C++), Version 6.1 is a maintenance release that fixes numerous bugs. Registered users of Version 6.0 can receive the upgrade at no additional charge.

In addition to the MultiScope debugger, Symantec C++ offers SLR Systems' speedy OPTLINK linker; Blue Sky Software Corp.'s code generator, Visual Programmer; and the Microsoft Foundation Classes (MFC) 2.0. The professional edition (\$499) lets you create DOS, Win16, and Win32s programs. A standard edition (\$129.95) contains a nonoptimizing compiler and generates only 16-bit programs.

IN-INTUITIVE IDDE

The new MultiScope-based development environment—dubbed IDDE, for Integrated Development and Debugging Environment—is a departure from the typical development environment provided with compilers. The IDDE is organized around "Views" and sports a tear-off palette that lets you change the View displayed in a window through drag-and-drop. Different Views include Source, Project, and Memory; there are 16 in all. If you drop a View palette icon on an open area of the desktop, a new window will open automatically; if it's dropped on an existing window, the window's contents will change.

You can also perform drag-and-drop operations between windows. For example, you can view memory by dragging a variable from a Data View into a Memory View, or you can disassemble code by dragging a source-code file from the Project View into an Assembler View.

View windows are free-floating rather than contained within a parent window, so



FACT FILE

Symantec C++ Professional, Version 6.1

Symantec Corp., 10201 Torre Ave.,
Cupertino, CA 95014-2132; 800-441-7234,
503-334-6054

List price: \$499.

Requires: 386-based PC or better, 4MB RAM (8MB recommended), 55MB hard disk space (full installation), DOS 3.3 or later, Microsoft Windows 3.1 or later.

In short: Symantec C++ Professional offers an intuitive and productivity-enhancing development environment, along with a speedy compiler and a strong set of programming tools. It can create programs for DOS (16- and 32-bit) and Windows (Win16 and Win32s), and it includes the Microsoft Foundation Classes 2.0 application framework. Version 6.1 is a maintenance release with numerous bug fixes. Not all elements of this product are tightly integrated, but the IDE represents a revolutionary advance.

ON-READER SERVICE CARD

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CIRCLE 241 ON READER SERVICE CARD FOR END-USERS

CIRCLE 331 ON READER SERVICE CARD FOR RESELLERS

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C++ Compilers

you can see your Windows desktop in the background. To minimize visual distraction, you'll probably want to minimize Program Manager after launching the IDDE. It would be nice if Symantec C++ did this for you automatically, but it does not.

Since you can't fit more than a few Views on-screen at once, the IDDE lets you save up to five desktop configurations, called "Workspaces," and quickly switch among them. Index-style tabs at the top of the screen let you select a Workspace with a mouse click.

The integrated editor has color syntax highlighting, but only four colors. The colors were not configurable in Version 6.0, but in response to customer demand, Symantec added limited customizability in Version 6.1. (You still cannot change

Though Symantec C++ includes a 32-bit DOS extender, its DOS support isn't uniformly strong. There is no DOS graphics library, which is a feature the Borland and Microsoft compilers do provide. You must purchase a third-party graphics library for graphics programming under DOS.

The 16-bit linker included with the compiler is OPTLINK 4, licensed from SLR Systems. (The 32-bit linker was

developed at Symantec.) OPTLINK is one of the fastest linkers around, and it produces reasonably small executables via a recursive technique that identifies and weeds out all unused code.

The technique of eliminating unused code from the executable is called "smart linking." Both Microsoft Visual C++ compilers support limited smart linking, but it isn't recursive. The Visual C++ linker will

SUITABILITY TO TASK

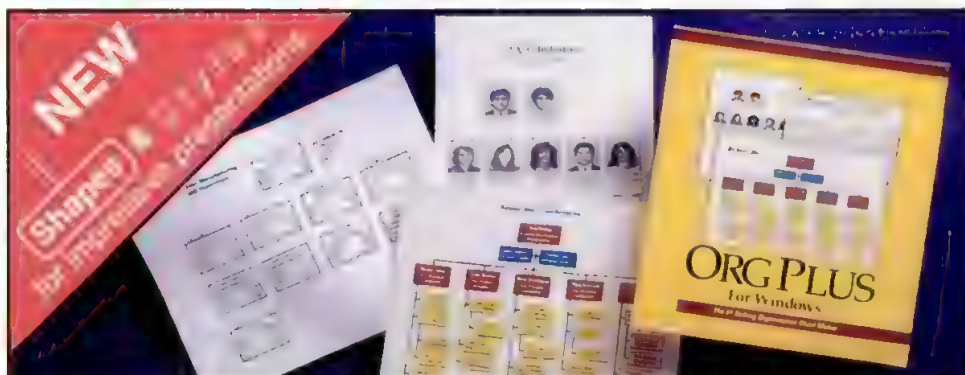
Symantec C++ Professional, Version 6.1

	POOR	FAIR	GOOD	EXCELLENT
Prototyping and fast application development	●	●	●	●
Windows development	●	●	●	○
DOS development	●	●	●	○
OS/2 development	N/A			
Windows NT development	N/A			

the background color or the "all other text" color.) The editor does not offer advanced features such as programmability or macros, and you unfortunately cannot replace the editor with one of your own choosing. Unlike the Microsoft and Borland development environments, the IDDE does not give you the ability to add your own tools to the menu.

HIGH-QUALITY TOOLS

The MultiScope debugger is fully Windows-hosted, with an intuitive graphical interface. Its sophisticated postmortem analysis facility, provided only in the professional edition, lets you take a snapshot of the system when it crashes and then use standard debugging tools to view the information. The debugger can be used with all the types of programs that Symantec C++ can generate except 32-bit DOS. FlashTek, the company that wrote the DOS extender for Symantec C++, sells a debugger called FlashView that can be used with 32-bit DOS programs.



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C++ Compilers

eliminate function A if it is never called, but it won't eliminate function B if it is only called by function A, itself uncalled. OPTLINK, however, will identify function B as unused and eliminate it from the executable.

Like both Visual C++ compilers and Borland C++, Version 4.0, Symantec C++ includes a code-generation tool. Visual Programmer, licensed from Blue

Sky Software, is actually a separate application that can be launched from within the IDDE. The code-generation components of Visual Programmer are called Switch-It Modules, or SIMs. An MFC 2.0 SIM comes with the compiler. The code generated makes some use of the MFC but often generates straight C code rather than deriving new classes from the application framework. If you prefer straight

C, you can purchase an ANSI C SIM from Blue Sky Software. Although Visual Programmer is a powerful, full-featured tool, its interface conventions are quite different from the rest of the IDDE. This makes it feel a bit "tacked on" to the rest of the product.

Like Powersoft Corp.'s PowerBuilder, Version 3.0, and some other recently released development tools, the professional edition of Symantec C++ provides a graphical front end to Intersolv's PVCS version-control software. The PVCS software itself must be purchased separately from Intersolv, but the graphical front end provides a more intuitive interface than you'd see otherwise.

Symantec C++ supports all x86 command sets, including the Pentium command set. Though it can't produce optimized code for the Pentium, the professional edition offers global optimization for all the other x86 command sets. Both the compiler and the debugger support templates, but not C++ exception handling. There is no standalone assembler, but an in-line assembler is provided.

Symantec C++ beat the competition in compilation speed on almost all of our tests. It was by far the fastest when compiling DOS programs from the command line, and it came in a close second when compiling from within the development environment. It did less well in terms of executable size and execution speed, coming in toward the bottom of the pack for both.

MANY BUG FIXES

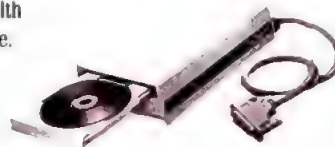
The first release of Symantec C++, which shipped in September 1993, was plagued by numerous bugs. Symantec responded by posting fixes on its bulletin boards and then consolidating the fixes three months later in Version 6.1. There are still some reported problems, but the product is now much more stable. Company response to bug reports has been exemplary.

Symantec C++ ships with a full set of printed manuals. The documentation is adequate, but it can be difficult sometimes to find specific items. Moreover, certain parts—the discussion of templates, for example—are not as clearly written as one would wish. There is extensive on-line help, but it is not context-sensitive. You cannot highlight a keyword and press F1 for syntax help, as you can with the Visual C++ com-



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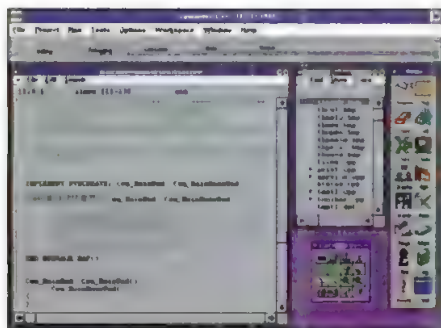
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The Views palette in Symantec C++ lets you use drag-and-drop to open or change windows.

ilers. But you can cut and paste examples from the on-line Help into your own programs. Excellent technical support is provided on Symantec's bulletin boards.

To make it easy for its customers to port code from the market-leading Microsoft and Borland compilers, Symantec has worked hard to enhance its products' compatibility with these products. This removes roadblocks, but the greatest strength of Symantec C++ is its development environment: Flexible, intuitive, and configurable, it's a real productivity tool.

Watcom International Corp.

Watcom C/C++¹⁶

Watcom C/C++³²

BY NANCY NICOLAISEN

The two editions of Watcom C/C++, Version 9.5, offer developers toolsets of particularly panoramic sweep. Admittedly, some of the ground they cover is pretty sparsely populated, especially in comparison with the environments of their glitzy IDE-based competitors. Still, Watcom C/C++'s ability to crank out tight, robust, highly optimized code for a wide range of 16- and 32-bit platforms will attract developers looking for superior code-generation technology and cross-platform reach.

CROSS-PLATFORM PROWESS

The 32-bit edition of Watcom C/C++ covers a dizzying variety of platforms, including extended DOS; IBM OS/2 2.x; Microsoft Windows NT, Win32s, and Microsoft Windows 3.1; Autodesk's Auto-

CAD ADS/ADI; NetWare Loadable Modules; and GO Corp.'s PenPoint. For developers of 32-bit DOS apps, explicit support is provided for Watcom's DOS/4GW, Rational Systems' DOS/4G, Phar Lap Software's 386/DOS Extender SDK, Ergo Computing's OS/386 Developer's Kit, Intel's 386/486 Code Builder Kit, and Autodesk's ADS-extender technologies. Also, tool support is provided specifically for developers of device drivers, embedded systems, and TSRs.

This impressive list is complimented by an expansive roster of host environments including DOS, OS/2, Windows NT, and Windows 3.1. The 16-bit version is hosted in DOS, OS/2.1.x, and Windows 3.x. Clearly, Watcom International Corp. aims to carve out a niche as the cross-platform developer's compiler of choice.

Both compilers offer full AT&T 3.0 C++ implementation, featuring support for exceptions, templates, and nested types. Watcom C/C++ provides its own set of generic class libraries, including iostreams, a set of containers, and complex number operations that will be of

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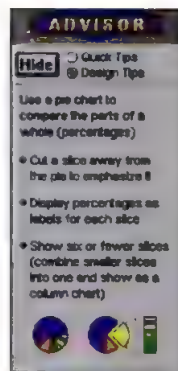
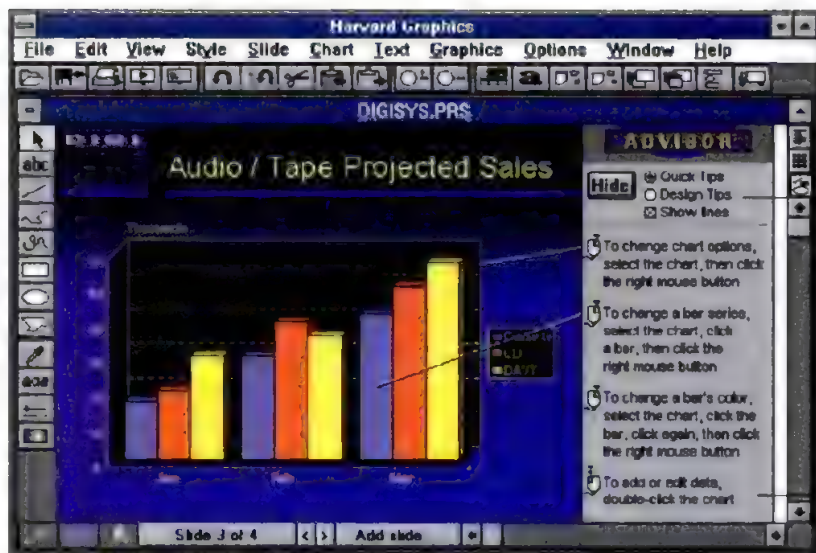
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C++ Compilers

interest to developers of scientific and financial applications. This is not the last stop in the search for comprehensive class libraries, but it does provide some highly useful tools for Watcom's traditionally mathematically oriented audience.

MECHANIC'S TOOLS

Watcom C/C++ continues Watcom's tradition of delivering "mechanic's choice" language products. Most of the tools included are very low-level, providing intimate contact with generated code. Watcom's close-to-the-metal, highly granular approach will prove especially powerful in tasks like NLM, TSR, and embedded-systems development.

Watcom tools are also notable for snapping cleanly into the toolsets of other Watcom languages. For example, the debugger treats mixed FORTRAN and C or C++ code as a seamless unit. This is partly because of good planning and partly because the two share a single code generator. A Watcom FORTRAN routine can open a file and allow a Watcom C++ routine to read and write to it using ordinary C

runtime calls or the supplied I/O streams. The reverse is true as well. Not many other language products boast interoperable file I/O and memory-allocation schemes across languages.

Watcom C/C++ also stands out as one of the first superscalar optimization technologies for Pentium-based computers. Put succinctly, these optimizations are performed by analyzing the instruction stream generated by the back end of a compiler and detecting complex, multi-cycle instructions. These complex instructions are then broken down into a series of smaller, simpler instructions.

After the code is recomposed using the shortest possible instructions, the compiler attempts to schedule instruction processing in ways that let the largest number of fetch, decode, and execution steps be handled in parallel. This takes advantage of the dual-

instruction pipelines of the 486 and the dual-execution units of the Pentium. As part of the scheduling analysis, the code generator must determine whether instructions depend on one another's outcome and therefore must be sequential. Watcom also claims that its Pentium optimizations will scale down very favorably to the 486, taking advantage of the 486's dual-instruction decode cycles.

What you cannot expect from this product is any degree of sophistication in the integrated-development-tools arena. It has no graphical environment and though certain components of its toolset are extremely powerful, they are strictly stand-alone elements. There is no editor, and the MAKE utility is a code-it-yourself arrangement patterned after the Unix facility.

These limitations compromise Watcom C/C++'s usefulness as a day-to-day toolset.

SUITABILITY TO TASK				
Watcom C/C++ ³² , Version 9.5				
	POOR	FAIR	GOOD	EXCELLENT
Prototyping and fast application development	●	○	○	○
Windows development	N/A			
DOS development	●	●	●	●
OS/2 development	●	●	○	○
Windows NT development	●	●	○	○

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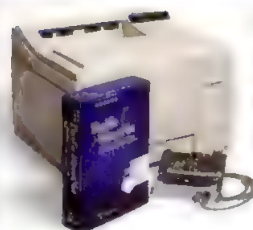
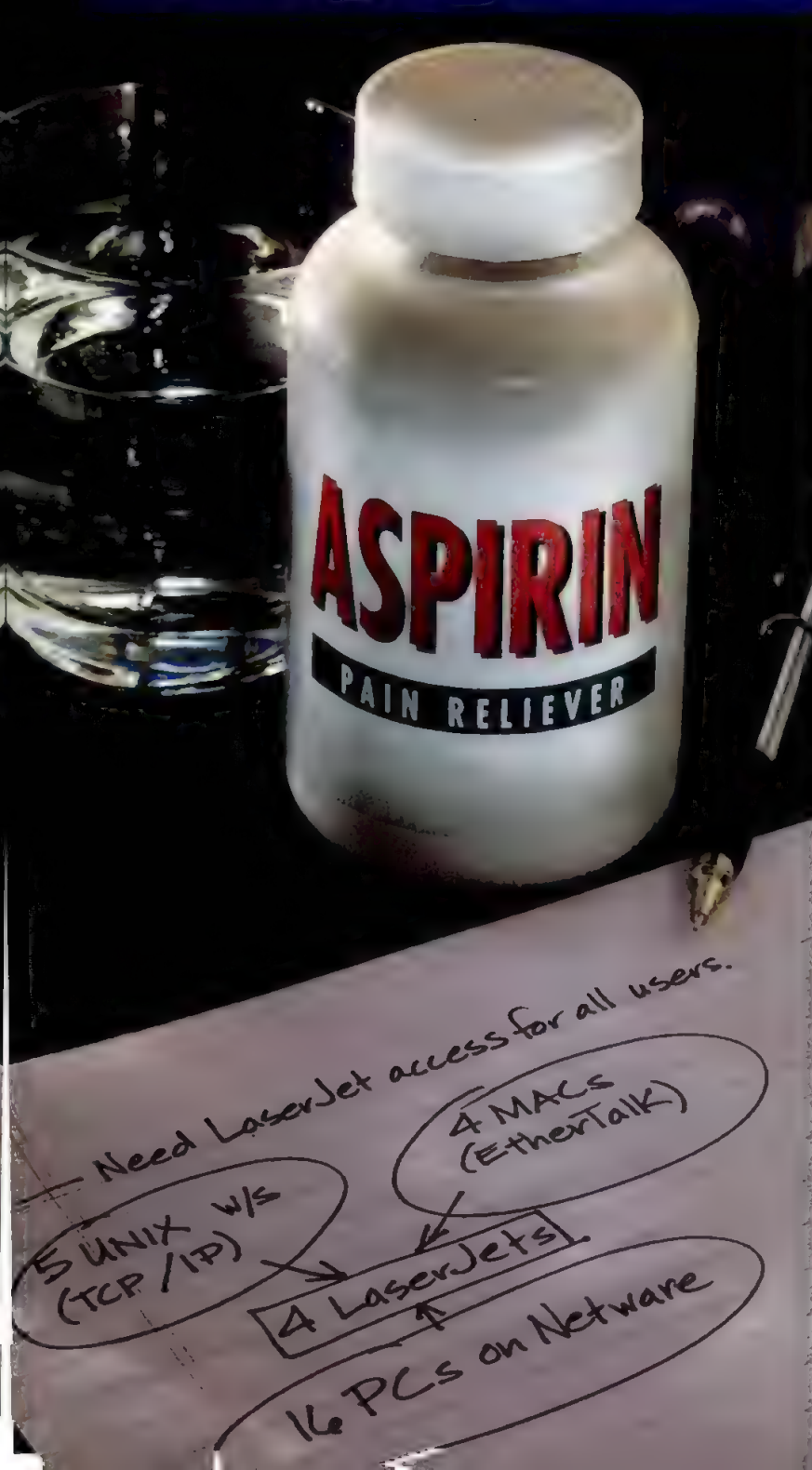
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Pacific DirectNet is engineered to simplify the entire printer sharing process, from installation to everyday use. Software is included that allows automatic setup on Novell networks. And with support for LPR/LPD, FTP, TFTP, and RShell, it's easy to setup and connect printers to any UNIX network—Sun, HP, IBM, DEC, SCO, Solaris, and Interactive UNIX.

For network managers, upgrading to the latest network operating system or to new features of an existing one is surprisingly simple. Just slip a disk into a PC and update Pacific DirectNet's Flash memory. There's even an SNMP agent that allows network management software to recognize and manage printers just like it does other network devices.

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PACIFIC DATA
PRODUCTS

C++ Compilers

Watcom C/C++ presents the sparsest of landscapes for Windows development. There are some Windows-oriented debugging aids, including a message-spying utility, a DDE spy, a heapwalker, and a post-mortem crash analyzer (dubbed "Dr. Watcom," after Microsoft's similar Dr. Watson). But there is neither a C++ application framework for Windows nor support for creating graphics resources such as dialogs, bitmaps, cursors, and icons.

SUITABILITY TO TASK

Watcom C/C++¹⁶, Version 9.5

	POOR	FAIR	GOOD	EXCELLENT
Prototyping and fast application development	●	○	○	○
Windows development	●	●	○	○
DOS development	●	●	●	●
OS/2 development	N/A			
Windows NT development	N/A			

Watcom's debugger, Video, is a well-crafted tool that covers all of the environments targeted by the compiler and offers typical breaking, watching, and tracing capabilities. It provides support for remote debugging, dual-monitor debugging, and screen-swapping for graphics applications being debugged on a single monitor.

Support for debugging threaded applications includes a window that displays thread information, as well as commands to change thread views, show thread information, and freeze or thaw a particular thread. The Call command lets you call any routine by address.

Despite its power, Video lacks the visual appeal and convenience of IDE-hosted debuggers. It also lacks the ability to execute repetitively a section of code without reloading the program and initializing data.

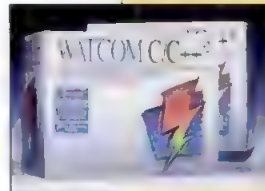
Compiler performance is where the proverbial rubber meets the road. While no test showing is entirely representative of every strength or weakness in a product, Watcom C/C++ showed consistently good optimization technology across a range of platforms during testing (for performance details, see the section "How We Tested"). The take-home lesson from its test performance is that cross-platform development efforts could achieve good-to-excellent optimization from a single code base using Watcom C/C++.

Optimization comes at the expense of

compile time, however, so using this product makes the most sense at a late stage in the development cycle. It's worth noting that Watcom-generated code is always optimized to some degree. It's not possible simply to skip the optimization process, either to improve compile speed or identify possible bugs introduced by optimization.

Watcom's documentation reflects the product's philosophy. It is well written and concise but all in book form. The nongraphical environment leaves no room for on-line documentation, much less context-sensitive on-line help. The inclusion of Bjarne Stroustrup's book *The C++ Programming Language* is a pleasant bonus in the 32-bit edition.

In sum, Watcom C/C++ isn't a mainstream developer's tool of choice, and it certainly isn't for newcomers to C++. But its strengths at optimizing code across a broad range of platforms and special abilities to handle tasks like NLM, TSR, and embedded-systems development earn it a place in any serious developer's arsenal. □



Watcom C/C++¹⁶, Version 9.5 Watcom C/C++³², Version 9.5

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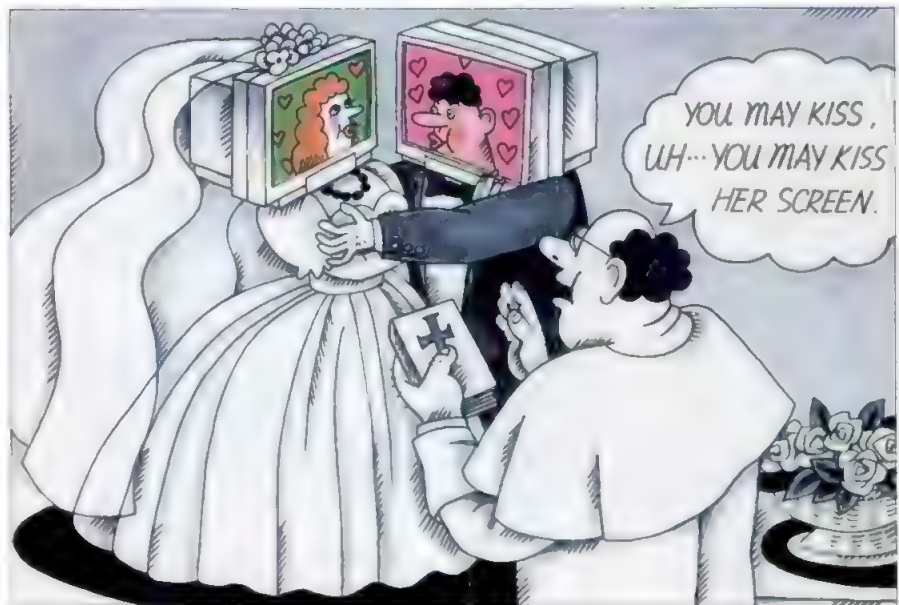
List price: Watcom C/C++¹⁶, \$495,
Watcom C/C++³², \$599

Requires: 386-based PC or better;
3MB RAM, 46MB hard disk space
(full installation), DOS 3.3 or later,
Microsoft Windows NT, or OS/2 2.x

In short: If code optimization is near the top of your list, either edition of Watcom C/C++ 9.5 is an excellent addition to your toolset. Each edition offers a clean C++ language implementation, and each has powerful, low-level tools that provide intimate contact with generated code. The 32-bit compiler targets a broad range of platforms and offers good-to-excellent speed and size optimizations across the lot. If you want the conveniences of a graphical IDE, look elsewhere. But for producing state-of-the-art machine code, this package is a must.

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NETWORK BACKUP

Performing Backup Magic

Sooner or later, your file server will lose its most precious resource: your users' data. It is up to you to work the magic that results in the faithful restore of your users' files. We've looked at nine packages that help you pull files out of the backup "hat."

As the network manager, it's up to you to make the prompt restoral of individual files or an entire server hard disk from backup into a reality. Your preparedness in this inevitable situation depends heavily on the backup solution you choose. And it stands to reason: A successful restore of valuable data is possible only with a successful backup.

Yet with so many backup solutions on the market which one do you choose? Good question. In this roundup, we set out to find the right backup solution for a small (or medium-size) server-based

By Gary Gunnerson

network. This is a size that represents a large portion of the network market. (Other packages in the backup spectrum address more basic network and individual system backup; still others address higher-end network backup needs. See the sidebars "Hold the Bells and Whistles" and "Accommodating a Data Storage Explosion on Your Network" for more information.)

We began by only looking at products that met two criteria: support for the popular NetWare 3.12—and by this we mean the ability to backup and restore the NetWare 3.12 file system, including the NetWare Bindery—and support for a popular digital audio tape (DAT) drive, the HP JetStore 5000E SCSI drive (\$2,100). We focused on DAT—and not QIC (quarter-inch cartridge), the other popular backup medium—because DAT provides great capacity (2GB to 4GB) and performance

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files created by different types of clients. Five other advanced features: disk grooming and file migration, support for multiple backup of data queues from many sources and to multiple simultaneous tape devices, data compression at the client, hierarchical storage management (HSM), and support for Novell's Storage Management Services (SMS) and the System Independent Data Format (SIDF) help to differentiate these products.

The end result of our assessment was

at relatively low cost (\$3,000 to \$10,000 for a drive). (Also see "How We Tested" and "DAT vs. QIC.")

The five key criteria important to the backup solution for a small to medium-size office are automation (ease of use, scripting), performance, quality of the interface, reliability, and ease of installation. We also looked at SCSI device support and the ability to back up

that three products—Palindrome Corp.'s Backup Director, Version 2.1; Cheyenne Software's ARCserve for NetWare—Windows Edition, Version 5.0; and Performance Technology's PowerSave, Version 3.10, for Novell—rose to the top for their sheer ability to work without a hitch and provide timely and reliable restores of valuable data. Of those three, Backup Director was designated our Editors' Choice for its combination of strong performance and the best tape-management scheme. ARCserve was a close second, turning in the best overall performance and the broadest support for multiple clients and operating systems (OSs). PowerSave proved that workstation-based backups can compete with server-based solutions; it provided the second-fastest time on our Single-File Restore test.

What surprised us most, though, was that a few of these packages exhibited major problems. Two of the nine could not complete our performance tests. Mountain Network Solution's FileSafe for Windows Rescue NLM, Version 1.0, could not handle the large number of files presented, and Systems Enhancement Corp.'s Total Network Recall, Version 1.70 (TNR), could not restore all of NetWare's files. (The vendors are addressing these problems.)

HIGHLIGHTS

Network Backup

MANAGERS OF SMALL TO MEDIUM

networks need backup software that is easy to install, easy to use, reliable, and fast. They need a package that supports them not only for full disaster recovery (in which a server hard disk is lost), but also for the far more frequent single-file restore.

BETTER PRODUCTS guide the backup operator through all the required steps in both backup and restore, prompting for tapes and notifying him in the event of a problem. A good restore is only possible with a good backup. So we look for a well-designed, flexible backup scheme with tape-management features and options for scripting and off-hours scheduling.

WE TESTED nine packages that back up a NetWare 3.1x server and support a popular DAT drive for their backup and restore features. We also timed their performance of a full backup, a differential backup, a single-file restore, and a full restore.

WE OBSERVED REMARKABLE disparity between these packages on all fronts. Some are full-featured and easy-to-use, but a few have interfaces that require some getting used to, and others could not complete our backup or restore tasks. Some were fast performers, taking less than an hour to back up our 860MB data set; others were excruciatingly slow, spending more than 2 hours on one task.

INTERFACES varied dramatically. Some are excellent (Windows or DOS); others are not intuitive and take the user through endless menus. And, while most of these packages perform the tasks they were designed to, some are simply better designed and easier to recommend. Overall, though, the group was reasonably priced.

THE FUTURE OF BACKUP is dynamic and will follow the explosive popularity of networking. Novell's Storage Management Services (SMS) promises a standard for third-party vendors of backup products, and the Standard for Independent Data Format (SIDF) promises a standard for tape formatting, but both are still developing.



EDITORS' CHOICE

• Backup Director, Version 2.1

Two other packages finished the tests but also exhibited problems: Legato NetWorker 2.2 for NetWare's "complete restore" menu selection corrupts the NetWare Bindery, and Fortunet's Nsure 1.20 NLM/AllNet had many bugs, including the truncating of Macintosh file names during restore.

AUTOMATE WHERE YOU CAN

Even a perfect backup of a file or volume is of little help if you cannot locate that data later. Automating the process gives you a better chance of a successful backup from which data can be located at a later date. With a solid package, the manager should be able to set up a tape-rotation scheme that ensures that tapes are labeled properly, and the operator should be prompted for specific tapes during a restore.

Even with software that makes backup easy to use, the LAN administrator must still organize the myriad of tapes in logical ways to provide complete data management. Here, you should keep concerns for off-site storage, disaster recovery, and locating specific tapes in mind.

No single function less associated with backup software can wreak more havoc during an emergency than the inability to locate the right tape. In this roundup, Palindrome Corp.'s Backup Director, Version 2.1, comes to the rescue with its Tower of Hanoi-based tape-management scheme, which makes tape location truly simple by tracking each one within its database. The software prompts for tapes by name, tracks tapes by usage for later removal, automates off-site storage, and creates a user-configurable number of copies of every file. This feature alone

When a network manager restores a file, it's okay if it appears to users as if magic were involved. But the network manager should never have to wish he actually knew magic just to put his hands on the right tape quickly. A sound backup and a good backup tape-rotation scheme form the foundation for any kind of restore. We

were impressed with the fact that Palindrome Corp.'s Backup Director, Version 2.1, provides a full-featured package in which the manager of a small network is relieved of much of the troublesome work of managing backup tapes.

In addition to the exceptional tape-management scheme, a well-designed interface, an easy installation, and good performance in both backup and restore testing all contribute to our recommendation of Palindrome's Backup Director as an excellent backup software package for a small (to medium-size) NetWare network. Its interface is proof you can have a good one that isn't Microsoft Windows-based. Backup Director's DOS interface has an easy-to-use directory tree structure, and pull-up menus that guide you through backup. And its Tower of Hanoi backup algorithm provides for confident backup.

Palindrome also includes excellent disaster recovery documentation—invaluable in the unfortunate event you need to use it. Backup Director walks you through reestablishing the backup database and your server. The prod-

uct's one shortcoming is that support for backing up DOS and Windows clients must be purchased separately.

We also give a strong honorable mention to Cheyenne Software's ARCserve for NetWare—Windows Edition, Version 5.0. A quality package that turned in the best performance numbers overall, ARCserve's strength derives principally from its powerful Windows-based indexing database. Its excellent Windows interface is a vast improvement over Version 4.0's DOS-based system, and does much to make the many features of this package more accessible.

In addition to its many standard features, ARCserve includes several advanced capabilities, such as tape-autoloader support, data migration, and database pruning. One particularly impressive feature is its parallel streaming, in which you can daisy-chain several drives on one SCSI adapter to run multiple backup operations simultaneously. ARCserve is a fine choice, but we determined Backup Director's tape-management scheme to be a valuable tool for managers of small to medium-size networks.

puts Backup Director far ahead of other packages with similar performance.

Backup Exec, Nsure, Total Network Recall, and Xpress Librarian do not provide tape-management functions at all; instead they leave the job up to the operator to manage the tape library.

ARCserve uses the grandfather-father-son (GFS) rotation scheme and has the capability to handle any number of tapes per backup set. It provides for daily, weekly, monthly, and annual rotations. FileSafe merely suggests rotation schedules and duplicate copies of tapes.

PowerSave uses a more restrictive modified GFS on a 28-day revolving cycle

with rigidly controlled tape names, but also includes a tape activity report for removing tapes from circulation. NetWorker includes retention intervals, but little more, within the policy section of its program where specific backup sets become controlled by their policies.

A big requirement for companies striving to make LAN operations efficient is the ability to do unattended backups during off-hours. This can prove difficult with Windows-based software, because not every mouse click has a direct corollary to a software action. Yet, each package tested claims to offer this facility.

ARCserve, for example, uses its

NETWORKING

Network Backup

Suitability to Task: Network Backup

Your backup software should act as an assistant assigned a chore—prompting you for input, giving you a clear idea about the status of things, and generally carrying out your wishes. Backing up and restoring a small (or medium-size) network has become easier with newer versions of software that automate more tasks for you. These packages give you more freedom to design and implement a good backup plan.

When judging a package's **disaster recovery** capabilities, we consider how well automated the recovery process is, the clarity of the interface, whether the documentation is helpful, and whether performance is acceptable. These packages must back up and restore the NetWare 3.x Bindery, but we note where a package also handles NetWare 4.x's NetWare Directory Services (NDS). Better packages make the job a step-by-step process, prompting for tape rotation and walking us through.

Auto Pilot Tape Management to save scripts to use with ARCserve Manager or ARCbatch. Interruptions in scheduled backups cause the software to reschedule those operations. Xpress Librarian allows you to save a script and the Scheduler module launches its unattended operations.

PowerSave uses a unique form-based approach to scheduled backups that produces an editable text file for later use by the scheduling software. NetWorker offers a sophisticated scheduler inherent in the software. In fact, NetWorker seems schedule-centric.

I NEED IT YESTERDAY

Software can be easy to use, fulfill needs for server backups, and fit well within budgets and operating environments and

SUITABILITY TO TASK				
Product Name	POOR	FAIR	GOOD	EXCELLENT
Disaster recovery				
Single-file restore				
Scripting and automation				
Multiplatform backup				

Single-file restore also requires a good menuing interface; finding a particular file or set of files should be quick and intuitive. The LAN manager should also be able to use wildcards and tag files by date. We recognize packages that allow individual users on the network to back up and restore their own files, and we take into account the speed of the process.

Scripting and automation are important to backup; we look at how easy it is to write and modify scripts, and how flexible scheduling is. Better packages allow the user to specify the backup times, as well as the type of backup to be performed—full, incremental, or differential. The

still be too slow at getting data back when the president of the company needs it right away.

In looking at the performance of these backup systems, single-file restore and server restore are crucial. These are the two most common restore operations performed in small offices. Single files are often lost because the file becomes corrupted or has been overwritten. Thus, we timed each package on restoring the file from the beginning, middle, and end of a backup data set.

But as we pointed out, a good restore is only possible with a good backup. So we timed both complete and differential backups as well (a complete backup backs up the entire data set, a differential backup backs up only those files that have been changed since the last full backup).

Our Contributors: GARY GUNNERSON is the manager of information systems for a Fortune 500 publishing company. PADRAIC BOYLE is a network project leader for Ziff-Davis Publishing Co. KEN MACKIN is president of Project Logic, a network consulting firm. JOHN GARRIS is a technical analyst and STEVE BUEHLER is testing coordinator (West Coast) at *PC Magazine*. KIM KELLY is an independent storage-industry analyst working in association with Peripheral Strategies. MICHAEL PETERSON is president of Peripheral Strategies, a market research firm specializing in storage management. JAMES KARNEY is a consultant and a frequent contributor to *PC Magazine*. GAIL SHAFFER was the associate editor in charge of this story, and ROBERT P. LIPSCHUTZ was the project leader.

scripts should allow the user to specify not only individual files and volumes, but how many days to wait before killing a backed-up file. We also assess whether you could back up multiple volumes from a single script. The software should keep track of—and prompt the user for—the correct tapes during a backup, and notify the user if the backup has failed. We also take into account the usefulness and ease of use of the error log.

In addition we assess how the packages perform **multiplatform backup**. On the client side, a good, flexible backup package should handle clients running DOS and Windows. We also noted support for Windows NT, OS/2, Mac, and Unix clients. On the server end, that means a complete and accurate backup of a NetWare 3.1x Bindery. We also give credit for packages that handle NetWare 4.x's NDS. And we give some credit to products that support NetWare 2.x, which is still running quite a few LANs. We also note support for other network operating systems. Under peer-to-peer support, we note support for LANtastic and Microsoft Windows for Workgroups 3.11.

We also simulated a complete drive failure, in which we had to install a brand new hard disk and perform a complete restore from the backup tape.

The products fell into three groups here. For full backups and restores, ARCserve, Backup Director, and NetWorker were the fastest, while PowerSave and Total Network Recall performed adequately. Backup Exec, Nsure, and Xpress Librarian trailed the group. In differential backups, NetWorker, Backup Exec, and ARCserve were the fast performers, with all but FileSafe and Xpress Librarian performing adequately.

Some surprising times were observed in our Single-File Restore test. Here ARCserve continued to perform well, but PowerSave also turned in a great time, and it was restoring from a client-based device. Backup Exec showed the third best time for this test and rounded out the faster performers. All the other products performed adequately except FileSafe and Total Network Recall (TNR took twice as long as its slowest competitor).

FILES AND FAITH RESTORED

Ensuring data integrity requires much more than a reliable backup. LAN man-

Benchmark Tests: Network Backup

How We Tested

We set up an Ethernet network with one NetWare 3.12 server—a Compaq Systempro XL/50 with 32MB of RAM and a 1GB SCSI hard disk—to see how these nine packages can back up and restore server data. For our administrator workstation, we used a Compaq Deskpro 486/33M with 16MB of RAM. Our tape drive was an HP JetStore 5000E 4-mm DAT drive with hardware compression, which was connected to either the server or the client (depending on the package) via an Adaptec AHA-1740 EISA SCSI adapter. Our test-bed also included a Compaq ProLinea 4/33 and an Apple Macintosh IIfx as network nodes.

Our data for backup consisted of about 860MB of various types of files. We included applications software and database, graphics, and text files.

We started with a **Full Backup** of the server, including the NetWare Bindery. We turned off the backup verify feature, and we left some files in use by applications to see how the packages dealt with open files. We then modified some files and performed a **Differential Backup**, timing the process and recording the results.

For our **Single-File Restore** from tape drive to server, we selected identical files from the beginning, middle, and end of our data set and averaged the three timings to determine the test score.

Finally, we performed a **Full Restore** of our NetWare 3.12 server. We recorded the time each product took to restore the entire server data set, including the Bindery. Then we checked to see that the product had properly restored all the files and their attributes, preserved Macintosh name spaces, and retained all user, password, and privilege information.

What the Numbers Mean

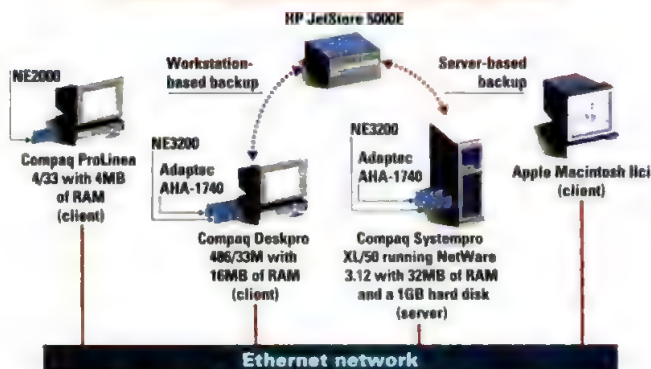
We looked for a clean handling of backups and restores. We found that two of the packages could not complete our testing. Mountain's FileSafe for Windows Rescue NLM could not perform a differential backup or either type of restore, and Systems Enhancement's Total Network Recall could not perform a full restore of our NetWare server.

An engineer from Mountain said that the problem had to do with the large number of files in our directories. Systems Enhancement has since corrected the problem, but we did not receive the bug-fix version in time for testing.

Most of the packages we reviewed process backup jobs on the server, although two—Performance Technology's PowerSave for Novell and Emerald Systems' Xpress Librarian—processed backup jobs on a DOS or Windows client. Because client-based packages must send all the server data over the wire before it is backed up, performance may suffer if there is a lot of concurrent network traffic on the wire while the backup job is in progress. Other considerations affecting backup performance include backup and indexing algorithms used by the backup software, and the throughput limitations of DAT drives.

The Single-File Restore time reflects the effectiveness of the tape index that the backup software uses to access files from tape. In most cases, these products required about the same amount of time to back up the server as to restore it.—*Analysis written by Robert P. Lipschutz and John Garriss*

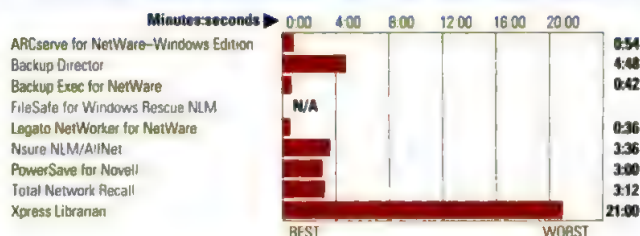
Network Backup Test-Bed



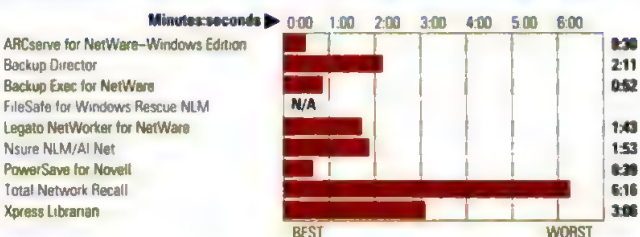
FULL BACKUP



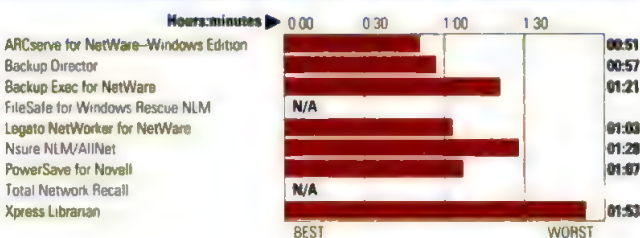
DIFFERENTIAL BACKUP



SINGLE-FILE RESTORE



FULL RESTORE



N/A—Not applicable. The product did not complete this test.



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agers must meet with their users and classify their data and needs in order to determine the minimum downtime allowable. Only then can a complete plan be made to meet business expectations and users' needs. Building an effective data restore process starts at the end and works its way back.

This also affects your backup plan and purchases. You must maximize your network's downtime in order to do backup; this window gets smaller all the time. Most sites buy as much tape device as they need to do their backup in the overnight window. We have noted whether each of these packages is server-based or client-based. A top consideration for hanging your tape drive off the server is whether you can accept having to reestablish your server before you restore. In a client-based solution, can you afford the performance hit you will take in having backup traffic flow from your server to a client?

We also note here that you should not merely trust your software/hardware solution once you put it in place. Besides following a good backup plan, you should also go through practice restores regularly. This accomplishes two things: You will know for sure that your data is being backed up correctly, and you will become familiar with your package. Then, if and when disaster strikes, you don't lose any time coming up to speed on those aspects of its operation.

When restoring files from tape, network administrators need to search the past records of backup operations without physically mounting each tape and spending time browsing directory structures. A product's ability to store this information on a server or client hard drive as searchable data makes the restore process easier by locating a file reference and referrals to specific tapes required to proceed with recovery.

The product's ability to create a fast and reliable catalog of servers, volumes, directories, folders, and files wins respect from managers under the gun to get their data back. The implementations vary considerably with ARCserve providing the only open solution by using Novell's Btrieve database software for storing its library.

Of course, you cannot restore data when the database required by the application no longer exists on a file server or client. So each package must somehow be able to restore its database after a complete drive failure. Most copy the entire library database to the last tape in each backup operation. We note, however, that Backup Exec and Xpress Librarian do not keep a copy of this file and must read the

Performing practice restores accomplishes two things: You will know for sure your data is being backed up, and you will become familiar with your package.

entire tape to recover the database.

Even where methods exist to browse file structures in preparation for a restore, some vendors complicate the process by using unindexed files, which slow down the procedure. Nsure does a presort of the database before displaying the file structure, which implies the lack of an index. FileSafe was quite slow, which suggests a poor database structure. Total Network Recall tracks Mac and OS/2 name spaces separately from DOS filenames, requiring three separate jobs for each backup session.

On the bright side, ARCserve searched the Btrieve databases quite quickly, whereas PowerSave used a linked list to locate and display the file structure quickly.

SNAP YOUR FINGERS

Generally speaking, the more graphical the software, the easier it is to use; for example, a graphical display of the directory tree structures makes software more accessible. Other pluses include logical menu structures and clean installation procedures. In addition, most backup software includes reporting tools. We looked for a system that includes reports for backup errors and allows for complete unattended backup to a single tape for lights-out operation in off-hours.

Although ARCserve was very easy to use, its powerful processes introduce complexity. Backup Exec, Xpress Librarian, and PowerSave all provide friendly soft-

ware and although Backup Director has a character-mode interface, it is a good one and proved easy to use.

Poor installation routines in Nsure and Total Network Recall kept us from using them right out of the box, leaving us with poor impressions when we had to make calls to technical support just to install. Backup Exec's installation, on the other hand, took only 15 minutes and proved intuitive and straightforward with automatic tape drive recognition.

NetWorker's menus always bounce the operator to the top menu, requiring a much higher level of user interaction than would be needed if the menus would always follow their hierarchical structure. FileSafe shows where object-oriented modeless programming is headed, but also demonstrates that an interesting new interface does not necessarily yield a functional program. NetWorker's declarative use of groups, schedules, policies, and directives could use some help from the character-based, terminal-like screens that exist in today's product.

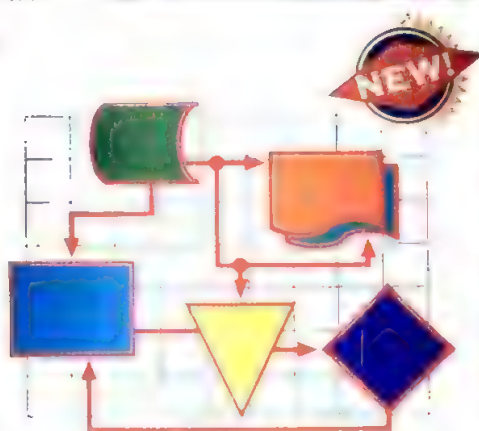
ADVANCING PERFORMERS

Support for Novell's SMS factors heavily in the multiple-client backup arena. (See the sidebar "Novell's Storage Middleman.") Our Summary of Features shows that products with SMS support usually also support Macintosh, OS/2, Unix NFS (Network File System), and FTAM (File Transfer and Access Method) name spaces, and they support DOS, Windows, OS/2, and Macintosh clients. Most vendors drop support for the older NetWare 2.x backups as they move toward SMS certification—a huge consideration for NetWare 286 shops.

Most network managers are more than happy, though, to have basic backup and restore performed cleanly and completely when expected. Yet beyond basic backup and restore operations, prospective buyers look for more sophisticated options to ease their data management concerns.

For example, network managers look for ways to extend the life of their limited hard disks. One way to stretch drive replacement time is to move little-used files off the server to tape or near-line

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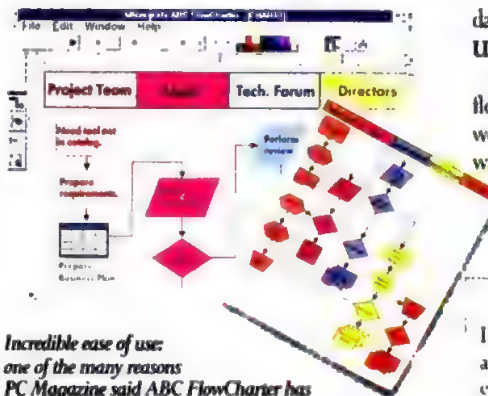
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storage available in tape carousels or optical jukeboxes. (See "Accommodating a Data Explosion on Your Network.")

File grooming means that files are actually moved off the server while *file migration* leaves a zero-length stub file on the server and supports automatic recovery from near-line storage to primary storage. ARCserve provides system messages through its FAXLIB.NLM, which uses NetWare's MHS to deliver backup report logs by electronic mail. Optional 25th line messaging can also keep managers apprised of backup operations.

Unique in this roundup, Total Network Recall can throttle CPU usage by backup processes. By reducing the effective load on the server, this could prove useful if you perform grooming during normal daylight hours.

ELEVATING BACKUP TO NEW ROLES

As most LAN managers know, one thing you can always count on is that the network disk storage will continue to expand. LAN backup must follow suit. Although this article concentrates on DAT drives, some buyers will want the latest and greatest support for additional LAN backup hardware. Tape autoloaders and carousels, and optical jukeboxes top some LAN managers' wish lists for hardware they would like to have (See "Accommodating a Data Storage Explosion.") Support for QIC, 8-mm, and DLT drives provides good tape options (see "QIC vs. DAT").

The first step, however, in the upgrade process merely attaches another tape drive to the existing SCSI bus. Good software will recognize the drive and use it to perform simultaneous operations to multiple tapes. ARCserve provides such *parallel streaming* during backup to multiple drives and can also restore from one drive while backing up to another. NetWorker can support multiple clients writing simultaneously to a single tape drive with support for concurrent backup devices just added in Release 2.2.

Arming yourself with the detailed information in the following reviews should prepare you well for choosing the right backup solution for your unique needs today—and a bit into tomorrow.

Cheyenne Software Inc.

ARCserve for NetWare— Windows Edition, Version 5.0

BY PADRAIC BOYLE

With its powerful indexing database, support for multiple operating systems, excellent retrieval performance, and numerous other features, including the best overall test scores here, ARCserve for NetWare—Windows Edition, Version 5.0, is a backup leader. Its only real functional drawback is minor: Setting up the more complex backup routines for this Cheyenne product may require an administrator to move among several of its screens.

ARCserve quality comes at a price—\$1,395 for the 25-user version, and then in increments that match the price increments for the NetWare licensing (upgrades from ARCserve 4.0 are \$95 to \$495, depending on the number of users). Thus, ARCserve may be overkill for network administrators on particularly tight budgets, who can live with less power and flexibility.

Installation was painless, although the software does not automatically recognize the SCSI adapter board installed in your server. During installation, a group of NLMs is copied to a computer designated as the ARCserve server.

The ARCserve manager software then can be accessed from any client on the network, or, for security, you can install it only on dedicated client PCs that can be kept apart from users or protected through the software. To operate any client as the ARCserve manager, though, you must load Novell's Btrieve requester, Version 6.10c, before you load Microsoft Windows.

Much of ARCserve's strength derives from its Windows-based database manager and powerful database engine. Multiple screens help you con-

figure the system for backup. Some backup and restore functions, and some other features, such as data migration and database pruning, require you to navigate through several screens to configure the package fully.

As with most of the products tested here, ARCserve supports full, incremental, and differential backups. It automates backup using the grandfather-father-son (GFS) tape-rotation scheme. This approach is supported by other products, but none has ARCserve's excellent interface, although the software isn't as helpful as Backup Director (which prompts for the required tapes during operation and takes

less time to set up). In our testing of both full and differential backup, ARCserve performed at or near the top.

ARCserve also provides some high-end features, including file migration, autoloader support, and database pruning.

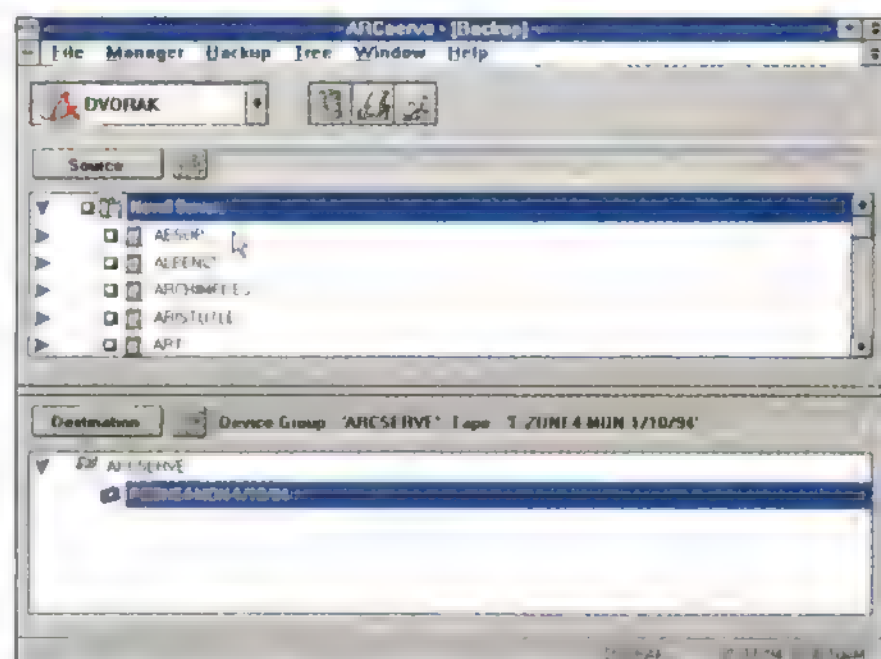
File search and retrieval are also ARCserve strong points. It scored the best on single-file and full restores, mainly because of the database's excellent index design and retrieval engine. You can search by name, by directory tree, and by date, and it supports wildcards. The ARCserve database must reside on a NetWare server.

The database is copied to tape during each backup. If the volume containing the database crashes, it can be recovered from tape. ARCserve performed admirably: The server's data installed without a hitch. The

SUITABILITY TO TASK

ARCserve for NetWare

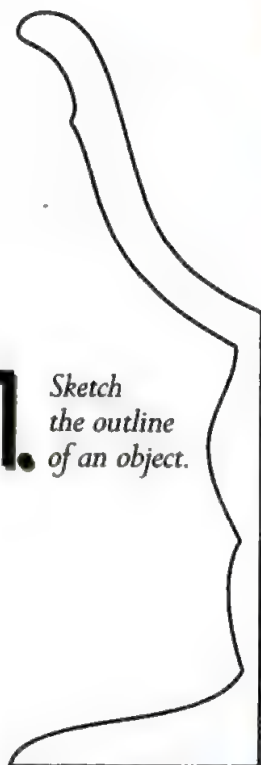
	POOR	FAIR	GOOD	EXCELLENT
Disaster recovery	●	●	●	○
Single-file restore	●	●	●	○
Scripting and automation	●	●	●	○
Multiplatform backup	●	●	●	○



ARCserve's Windows interface makes choosing servers and clients for backup easy by dividing them into logical groups.

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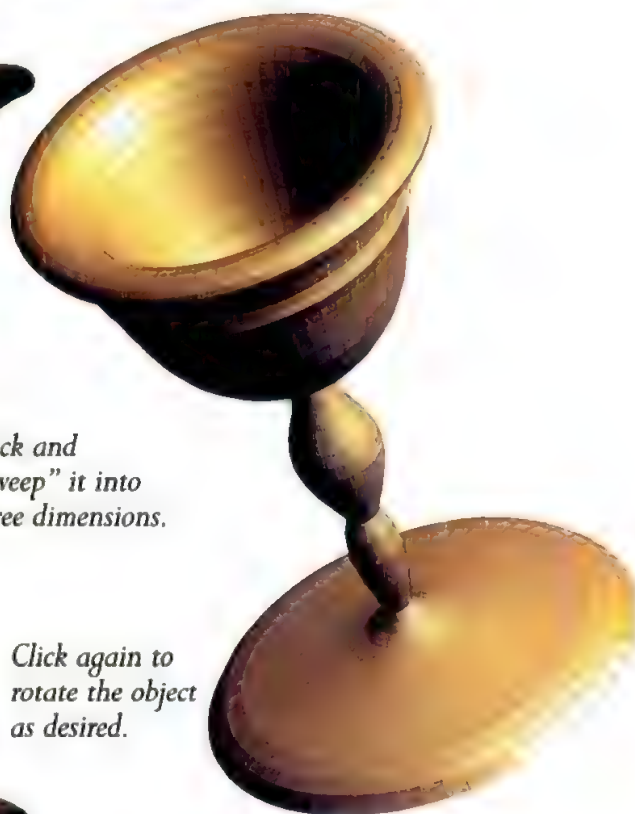
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▪ Accommodating a Data Storage Explosion on Your Network

By Kim Kelly and Michael Peterson

Network data capacity is growing by an estimated 60 percent each year, propelled by the requirements of client/server configurations; storage-intensive applications such as Windows; image and graphics storage; e-mail with embedded fax, data, voice, and video; and all forms of multimedia document storage. Larger networks require a different approach than is provided by the software solutions reviewed in the main article here.

If your network is pushing the limits of these standard backup solutions, you should consider a more advanced approach, such as establishing a backup server or moving to hierarchical storage management (HSM). A backup server is a dedicated computer placed on the network backbone that provides backup services to a number of workgroups or LANs. This might also involve automating your entire backup process. Do not, however, confuse automation with unattended backup. Unattended backup still relies on human intervention for changing tapes and monitoring activity. Automation removes the chance for human error.

Automation, through the use of a tape autoloader or library alone can offset 75 percent of labor costs, pays for itself before long while providing more reliable operations. For about two to three times the price of a single drive, you can get six or more times the capacity. A complete digital audio tape (DAT) loader solution with the ability to back up 24GB, using the newer DDS-2 format 4GB DAT drive technology and a six-cartridge magazine,

will cost from \$8,000 to \$10,000.

If you require fault-tolerant operation or very fast network backup and restore speeds, you might also consider a tape array. Starting under \$20,000 for 20GB to 48GB, arrays can support up to seven DAT drives in a single chassis. The seventh drive, dedicated to recording parity information, allows data reconstruction in the event of a cartridge or drive failure. Tape arrays achieve high performance levels by *striping* data concurrently across all tape drives.

If your network is pushing the limits of standard backup solutions, consider a backup server or an automated approach that uses hierarchical storage management.

Backup servers such as Intel's StorageExpress XLE (about \$12,495), manage the entire backup process from a centralized point, back up servers and clients, manage tape-rotation tasks, and groom the disk of inactive files—all of which simplifies administration. A backup server can provide for continuous backup of files as they are changed, using network idle time to avoid impeding network availability.

HSM: COMPLETE STORAGE MANAGEMENT

If you find that all your data needs to be on-line all the time or that you are frequently out of disk space and are spending an inordinate amount of time, managing disk space as well as scheduling backups, archiving and restoring files, consider investing in HSM. In hierarchical storage manage-

ment, files are stored on the lowest-cost device that can support the performance required.

HSM systems store data but also migrate data among various storage devices such as hard disks, optical disks, and tape, depending on access requirements. HSM capabilities include automated archiving; file migration; user-transparent retrieval; disk volume-capacity management; support for multiple device levels such as magnetic disk, optical disk, and tape; distribution of data on servers and clients, and even management of objects (non-file structures) at all levels of the hierarchy.

Software backup solutions for NetWare networks built on HSM cost from about \$3,000 for basic features to more than \$7,500.

Two vendors shipping today are Conner Storage Systems, with its Conner HSM product, and Palindrome Corp., with its Network Archivist HSM software. Both solutions can be configured to back up both servers and clients and offer support for tape autoloaders and optical disk drives.

For a complete 48GB system using a dedicated tape server, a DAT autoloader, and DAT drive for backup, be prepared to spend up to \$30,000. For a 68GB system with optical disks for faster data retrieval (the optimal choice), you can pay over \$50,000. If this seems high, remember that the cost of purchasing and managing it can be paid back in less than one year by a good HSM system. If it seems to fit, consider choosing automation and an HSM system. It will be one of your best investments. □

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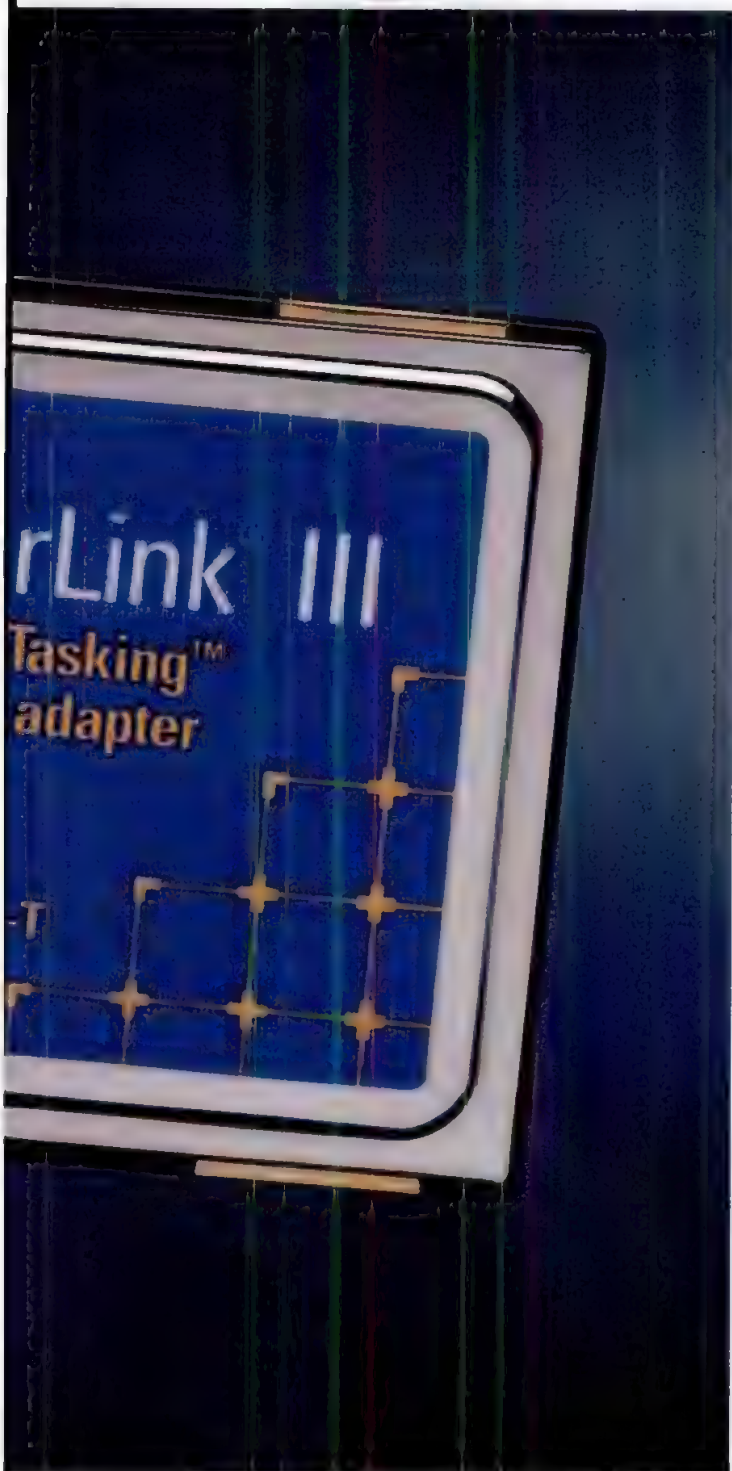
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Network Backup

disaster-recovery procedure was well documented and easy to follow.

DOS, Windows, OS/2, Mac, and Unix clients are supported with agents loaded on each client, although only DOS, Windows, and OS/2 support are included. The Mac agent is \$495, and Unix agents run \$495 to \$695, depending on the version of Unix. Clients may only be backed up by the ARCserve manager and users cannot restore their own files, unless they have access to the manager software.

FACT FILE

ARCserve for NetWare—Windows Edition, Version 5.0

Cheyenne Software Inc., 3 Expressway Plaza, Roslyn Heights, NY 11577; 800-243-9462, 516-484-5110; fax, 516-484-3446.

List price: Up to 5 users, \$395; up to 10 users, \$795; up to 25 users, \$1,395; up to 50 users, \$1,695; up to 100 users, \$1,895; up to 250 users, \$2,395. Workstation agent option, \$495 to \$695; database agent option, \$495 to \$4,995.

Requirements: Server: 386-based PC or better, 4MB RAM, 4MB hard disk space, NetWare 3.1x or 4.01 (Bindery emulation only). Client: 12MB hard disk space, Windows 3.1 or later.

In short: ARCserve's excellent performance and an ability to back up Mac and Unix systems, combined with a powerful database design have made it an industry leader. File search and retrieval are among ARCserve's strong points, but it has many others. You do, however, pay a higher price for this function and flexibility.

ON READER SERVICE CARD

ARCserve 5.0 supports NetWare 4.x only in Bindery Emulation Mode, but not 4.x's NetWare Directory Services (NDS). By the time you read this, though, ARCserve 5.01, with support for NDS, is scheduled to be released. ARCserve 5.01 also will support SMS 2.0. Cheyenne also markets a backup package called ARCSolo, a client-based product that is geared to the workgroup or peer-to-peer market.

Palindrome Corp.

Backup Director, Version 2.1

BY PADRAIC BOYLE

Palindrome Corp.'s Backup Director, Version 2.1, saves you from much of the hassle of network backup by automating

most of the process. With advanced features, good speed, and easy installation, backup, and restore, this package should be one of your top considerations.

Backup Director has a few drawbacks, one of which is its lack of included support for the backup of client systems. A separate package that adds support for DOS, Windows, and OS/2 clients is \$695. Neither does it include collapsible directories, which hinders its performance and ease of use somewhat. Overall, however, this is a quality package.

Although the package does not include a Windows interface, installation was simple because of the well-done text-based menu system. You simply copy a group of NLMs onto the chosen backup server. Because some of the package runs at the server's console, you also need to load both REMOTE and RSPX at the server and RCONSOLE at the client system that you'll use to control the software remotely. As these programs all come with NetWare, this process is, at most, inconvenient for some administrators; others may already have these files loaded.

Much like Palindrome's higher-end product, Network Archivist, Backup Director automates the backup tape-rotation scheme for you. Based on the Tower of Hanoi algorithm—the only such product here—which is used in many mainframe and minicomputer environments, Backup Director first backs up all files completely three times (by default), and thereafter only backs up, on several tapes, those files that have been changed. This ensures a good backup of each file, and several copies on hand for a user-specified amount of time. Because of this, the terms *full*, *differential*, and *incremental* do not apply.

Unlike any other backup software tested here, Backup Director tells you which



Backup Director's clean, easy-to-use interface is one of ways the product simplifies the job of a network manager.

tape should be loaded in the drive, when a tape should be archived off-site, and when an archived tape should be retrieved for use during restore.

Restoring files with Backup Director is easy and intuitive. When you choose a file to restore, a file history is displayed listing differently dated versions of the file on the same screen. When you have chosen the file version you want, Backup Director prompts for the proper tape to be loaded. This is useful in the event that a file on a particular day is corrupted; you may choose another instead of having to search through different save sets to find an uncorrupted version.

Palindrome supplies excellent documentation on how to restore the database completely after a disaster. One

drawback, though, is Backup Director's inability to back up clients. This feature is available in Palindrome's higher-end backup product, Network Archivist. Neither product

currently supports SMS, although Palindrome has announced that both Backup Director and Network Archivist will. Network Archivist already supports System Independent Data Format (SIDF), and SIDF support is planned for Backup Director.

Although not as fast as ARCserve, Backup Director did perform quite well in our restore testing.

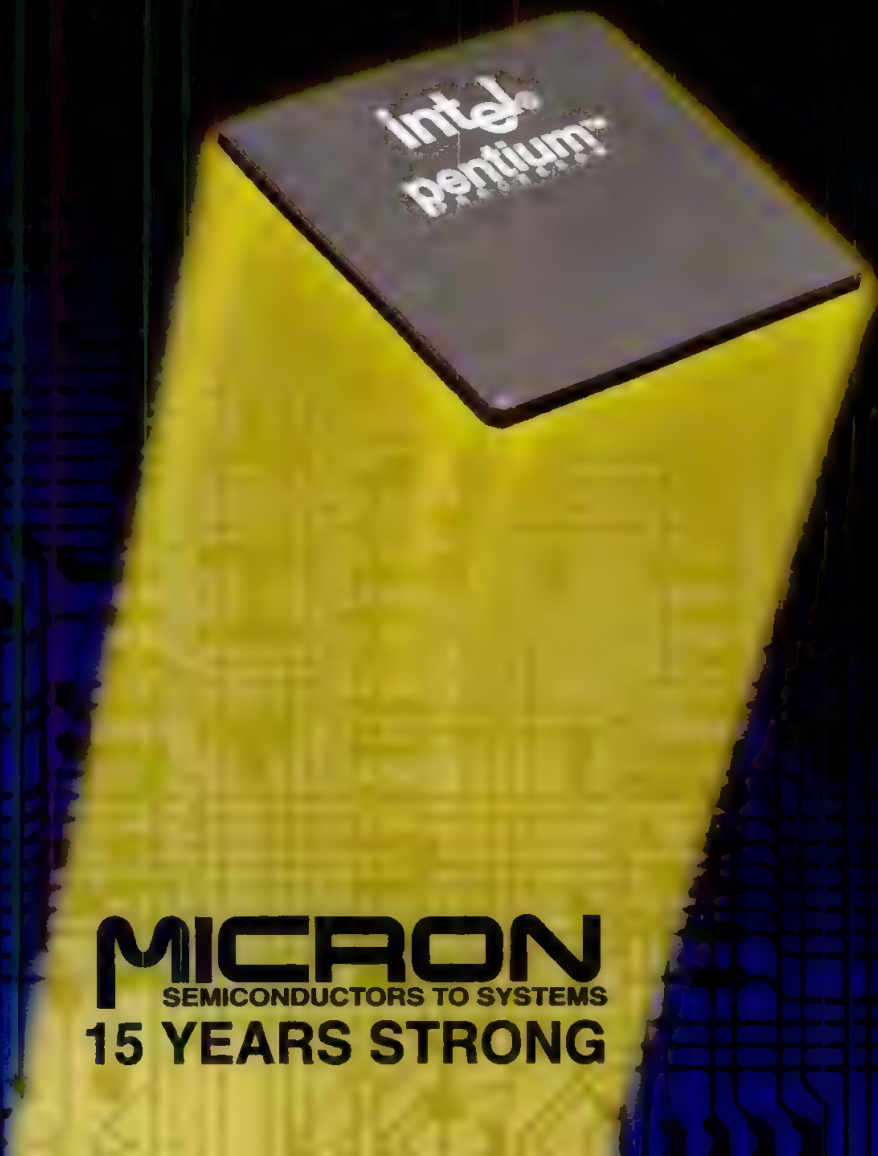
With its ability to automate most of the

SUITABILITY TO TASK

Backup Director

	POOR	FAIR	GOOD	EXCELLENT
Disaster recovery	●	●	●	○
Single-file restore	●	●	●	●
Scripting and automation	●	●	●	●
Multiplatform backup	●	●	●	○

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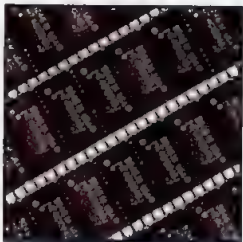
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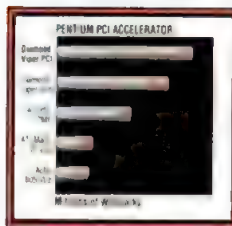
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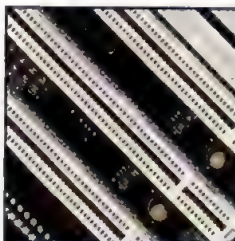
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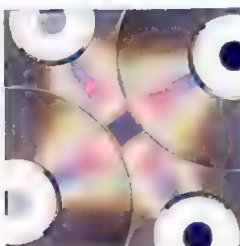
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FACT FILE

Backup Director, Version 2.1

Palindrome Corp., 600 East Diehl Rd.,
Naperville, IL 60563; 708-505-3300;
fax, 708-505-7917.

List Price: DOS or NLM version, \$795; Capacity Expansion Software (doubles backup capacity), \$795 each.

Requirements: Server: 286-based PC or better, 4MB RAM, 2MB hard disk space. Client: 286-based PC or better, 640K RAM, 1MB hard disk space, DOS 3.1 or later.

In short: Backup Director offers you high-end automation features. And it takes the guesswork out of your tape-rotation scheme, making network backup simpler for administrators. Other features, including an excellent disaster-recovery strategy, file backup based on an advanced algorithm, and good performance also contribute to making Backup Director a fine choice.



rotation process—to take the guesswork out of which tape goes where when—Backup Director removes much of the burden for network managers. Combined with its overall ease of use, a proven backup scheme, and better-than-average speed and price, Backup Director is an excellent product with more than enough features to back up most small and medium-size networks.

Conner Storage Systems

Backup Exec for NetWare, Version 4.0

BY JOHN GARRIS

Conner Storage System's Backup Exec for NetWare, Version 4.0, is easy-to-configure and feature-rich. Despite lacking a few arguably advanced capabilities (such as built-in tape rotation) and a better executed full restore, it is a suitable choice for many companies.

Perhaps Backup Exec's best feature is its support for NetWare 3.x and 4.x servers, as well as DOS, Microsoft Windows, OS/2, Mac, and Unix clients. You also get

a choice of DOS, Windows, or NLM-based client software to run the package.

Installation took only 10 minutes for the server and 5 minutes for each client. In addition, Backup Exec automatically configures the connected tape drives, while some other packages in this story require you to do so manually.

The Windows-client menu choices are clear, and dialog boxes bring the program's functions to your fingertips. Backup, restore, and file navigation are a snap. You cannot look for a backed up file across all tapes simultaneously.

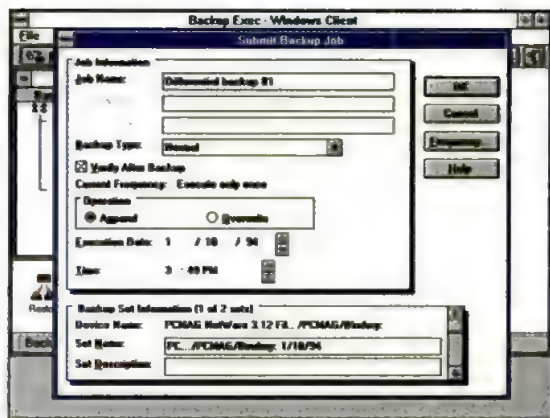
For those who don't want to use the Windows interface Backup Exec includes a DOS-client program and an NLM-based program from which you can submit backup jobs. Note that you must use the NLM if you plan to back up Mac or Unix clients.

In our backup tests, Backup Exec performed acceptably, doing a full backup of our 860MB data set in about 1 hour 25 minutes. Single-file restore from tape is quick and easy. Backup Exec maintains a tape catalog on the server that contains information about each file on every backup tape. To restore a file, you simply select the file and directory from the list, then click on the restore button.

Backup Exec also includes a search feature that allows wildcards to be used in place of full filenames. Network administrators can restore files from backup jobs submitted by anyone on the network; other users can only restore files from backup jobs they submitted.

We did, however, run into some problems with Backup Exec when we tried to perform a full restore of a NetWare 3.12 server. The trouble was not with the documentation, which includes a clear, step-

by-step guide for disaster recovery (invaluable for network administrators). Rather, after we reinstalled Backup Exec, we had to recatalog our backup tape sets onto the hard drive in order



By sorting backups by jobs and sets, Backup Exec makes it easy to configure and run backups and restores.

for the software to know the contents of the tape.

For a single tape with 860MB of data, this process took 2 hours 20 minutes—compared with 5 minutes under most of the other packages reviewed here. Worse, as we performed the full restore, Backup Exec overwrote our newly creat-

FACT FILE

Backup Exec for NetWare, Version 4.0

Conner Storage Systems, 36 Skyline Dr.,
Lake Mary, FL 32746-6201; 800-526-6637,
407-263-3500; fax, 407-263-3555.

List price: Server software: \$995. Client software: for Windows NT with SCSI or DC2000 tape drive, \$349; for DOS/Windows with SCSI tape drive, \$149; for OS/2, \$199.

Requirements: Server: 386-based PC or better, 2MB RAM (above server requirements), 10MB hard disk space, NetWare 3.11 or later. Windows client: 1.25MB hard disk space, Windows 3.1 in Enhanced mode. DOS client: 386-based PC or better, 512K RAM, 1MB hard disk space, DOS 3.3 or later.

In short: Backup Exec's intuitive interface and ease of operation, combined with Mac and Unix support at no additional cost, make it a logical choice for network backup. But its lengthy tape recataloging process and lack of automated tape rotation keep it a notch below the leaders.



ed catalog and replaced it with the catalog residing on the backup set, forcing us to recatalog our tape yet again. In the end, all of the data was restored, but the process took far longer than should be necessary.

SUITABILITY TO TASK

Backup Exec for NetWare

	POOR	FAIR	GOOD	EXCELLENT
Disaster recovery	●	●	○	○
Single-file restore	●	●	●	○
Scripting and automation	●	●	●	○
Multipatform backup	●	●	●	●

• Hold the Bells and Whistles

If your network backup needs are quite basic, some simpler, less expensive programs might do the trick.

By Steve Buehler

The LAN backup packages in this roundup are effective, complete tools, but they may be overkill for you. Not everyone needs advanced features such as scripting and automation, or tape-management schemes, or all those other bells and whistles.

If your NetWare network is pretty basic, you may find that you already have sufficient tools to meet your network backup and restore needs. You might consider SBACKUP, a program Novell includes with NetWare, Version 3.11 and above (Novell Inc., 800-453-1267).

You might also consider a PC-based package that supports backup of the Bindery. The market leaders are Central Point Software's \$129.95 Backup for Windows, Version 2.0, and Backup for DOS, Version 8.0 (Beaverton, Oregon; 800-964-6896) and Symantec Corp.'s \$149 The Norton Backup for Windows, Version 3.0 (Cupertino, California; 800-441-7234). Both provide some scripting, some level of automation, and interfaces that are easier to use than SBACKUP's.

Still, Novell's SBACKUP remains the simplest and least expensive Net-

Ware backup solution, though it is extremely limited: It does nothing more than basic—albeit complete—backup of file servers. It supports Novell's Storage Management Services (SMS) (see the sidebar "Novell's Storage Middle Man") and writes its backups in System Independent Data Format (SIDF) draft-standard format, allowing the administrator of a small or remote-office LAN to use it for disaster recovery. SBACKUP can automate only one backup event, and does not help manage tape volumes. It does handle full, incremental, and differential backups but delivers only minimal protection.

Central Point's Backup offers the ability to schedule numerous backup events during a week or month, to catalog backup results, to support myriad proprietary and SCSI devices, and to allow you quick access to backed-up data. It also permits virus scans (but not repairs) of target files before backup. Currently the NetWare-specific information may only be backed up to SCSI tape devices. The utility also includes niceties such as file viewers, scripting of specific backup sets on particular days, and backup selection of servers either by server

use, and reliable. If the package had a more intelligent tape recataloging algorithm and included automated tape rotation, it could very well find itself in with the leaders in backup software.

Mountain Network Solutions Inc.

FileSafe for Windows Rescue NLM, Version 1.0

BY KEN MACKIN

Mountain Network Solution's FileSafe for Windows Rescue NLM is a new prod-

uct, and, as perhaps can be expected in a 1.0 release, it exhibited problems during testing. In fact, it did not complete either of our restore tests or our Differential Backup test. It also has an interface that

name or drive letter. Symantec's The Norton Backup provides PC users with fast, safe backups. The Norton Backup has always had the ability to automate backups and maintain full tape catalogs and has in general set the speed standards for this product area. The latest version adds support for the Bindery as well as Microsoft's LAN Manager and Windows for Workgroups and Artisoft's LANtastic. Although it lacks the viewers and virus checking of Central Point's Backup, The Norton Backup allows network users to access a tape drive on any networked machine. All users can back up their client PCs to the same tape. It provides the same excellent level of backup and restore capabilities as Central Point's Backup as well as full, incremental, and differential backups; comprehensive scripting and backup cataloging; and limited tape autoloader support.

If you already have either of the two PC-based programs and your backup needs are small, using them will still leave you with the task of maintaining your own tape logs and rotation schemes, which will become a more pressing concern before long as your network grows. But for a small installation, they are certainly reasonable options that will give you peace of mind at a low cost. □

Another shortcoming is that although the manual discusses tape-rotation schemes extensively, the program does not support them directly. While a few other packages kept track of all the tapes used in a rotation scheme, prompting us when to change them or put them into the vault and telling us the name of the tape to use for the next backup job, Backup Exec required us to track this information ourselves.

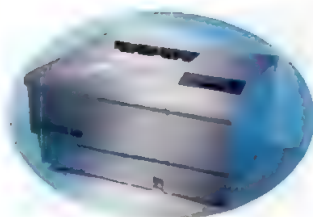
Conner also offers a client-based product called Conner Backup Exec for DOS/Windows—included with Backup Exec—as well as products for OS/2. In general, Backup Exec is straightforward, simple to

SUITABILITY TO TASK				
FileSafe				
	POOR	FAIR	GOOD	EXCELLENT
Disaster recovery	●	○	○	○
Single-file restore	●	●	○	○
Scripting and automation	●	●	●	○
Multipplatform backup	●	●	○	○

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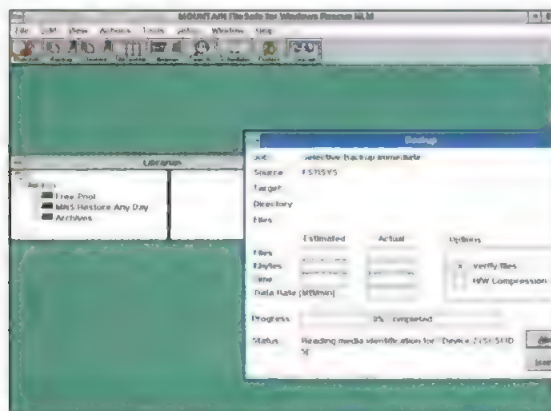
takes some getting used to, but the package does show good potential.

The first thing you note about FileSafe is its object-oriented interface. Unlike the other products we tested, FileSafe does not walk you through a set of choices, but instead allows you to construct an action from a series of separate menus and icons.

If you want to restore a single file, for example, instead of selecting a menu choice like "restore single file," you use the Librarian window to choose the group of tapes to search. The default choices are a Free group, a Restore Any Day group, and an Archive group. You also can create your own groups, which act like file cabinets. You then click on the FileSafe Search icon and enter the file name. FileSafe responds with the first instances of the matching file or files.

You can search by date, include subdirectories, and select specific disk volumes. But be specific or you'll wait a long time for the search to complete. And, if FileSafe finds more than 100 matches, it returns an error message.

The process is the same for backup and



Although FileSafe's interface looks typical for Windows, its object-oriented design took some getting used to.

FACT FILE

FileSafe for Windows Rescue NLM, Version 1.0

Mountain Network Solutions Inc., 360 El Pueblo Rd., Scotts Valley CA 95066-4268;
800-458-0300, 408-438-6650;
fax, 408-461-3047

List price: \$499

Requirements: Server: 386SX-based PC or better, 8MB RAM, NetWare 3.11 or later, compatible adapter and tape drives. Client: 4MB RAM, 3MB hard disk space, Windows 3.1 or later running in Enhanced mode.

In short: FileSafe's interesting interface does little to offset a slew of bugs and compatibility problems. It had trouble with multiple SCSI cards and would not work with tapes used by other products (a bug Mountain says is now fixed). Even though it is SMS-compatible, FileSafe choked when it encountered earlier versions. Until Mountain irons out these problems—and better the test scores—look elsewhere for backup help.

 (ON READER SERVICE CARD)

1.01—as we identified problems. But our full test suite had already been performed on version 1.0, the initial shipping version, and subsequent versions did not arrive in time for full testing.

At 1 hour 23 minutes, FileSafe was among the average performers on our Full Backup test, which used an 860MB data set of about 1,200 files. And when we attempted a restore it had trouble displaying the contents of our directory; it reported an out-of-memory error.

We were able to do some anecdotal testing at another site and found that FileSafe worked with a 300MB data set with fewer files. This suggested to us that it simply has trouble with large numbers of files. It was probably not able to restore because of these issues.

We also ran across some other problems in the off-site testing. The program aborted when we had a BusLogic SCSI card installed in the server in addition to the Adaptec card that Mountain requires. Mountain is working to allow the product to work with multiple SCSI cards, but until then you must stick with one card.

FileSafe also choked when it encountered previously format-

restore. In fact, once you get the hang of it, it seems like backup, restore, verify, and search are nearly the same in execution. With FileSafe, though, you need a target, a destination, and an action to accomplish most tasks.

We encountered many problems with both backup and restore, giving us the impression that the product had not been fully tested by the vendor. Compounding the difficulties was the fact that Mountain sent us three successive versions of the product—1.0, 1.0a, and

ted tapes, forcing us to use brand-new ones. Mountain has promised a fix for the problem. Finally, when we had an Archive Python DAT drive attached to the SCSI bus, FileSafe aborted, even though two compatible Sony drives were also present. It should have been able to use one of those.

Once we worked through these issues, FileSafe still occasionally responded with frustrating error messages, such as "Error: application internal warning." Viewing the log file gives you more information, but you will need Mountain's tech support to decipher it entirely. Moreover, FileSafe's early attempt to support SMS has not been entirely successful because that standard is still in draft format.

Keeping in mind the program's speed, compatibility, and bug problems, it would be hard to recommend the current incarnation of FileSafe. Still, there is potential here, and the unstructured interface may indicate the shape of things to come.

Legato Systems Inc.

Legato NetWorker 2.2 for NetWare

BY KEN MACKIN

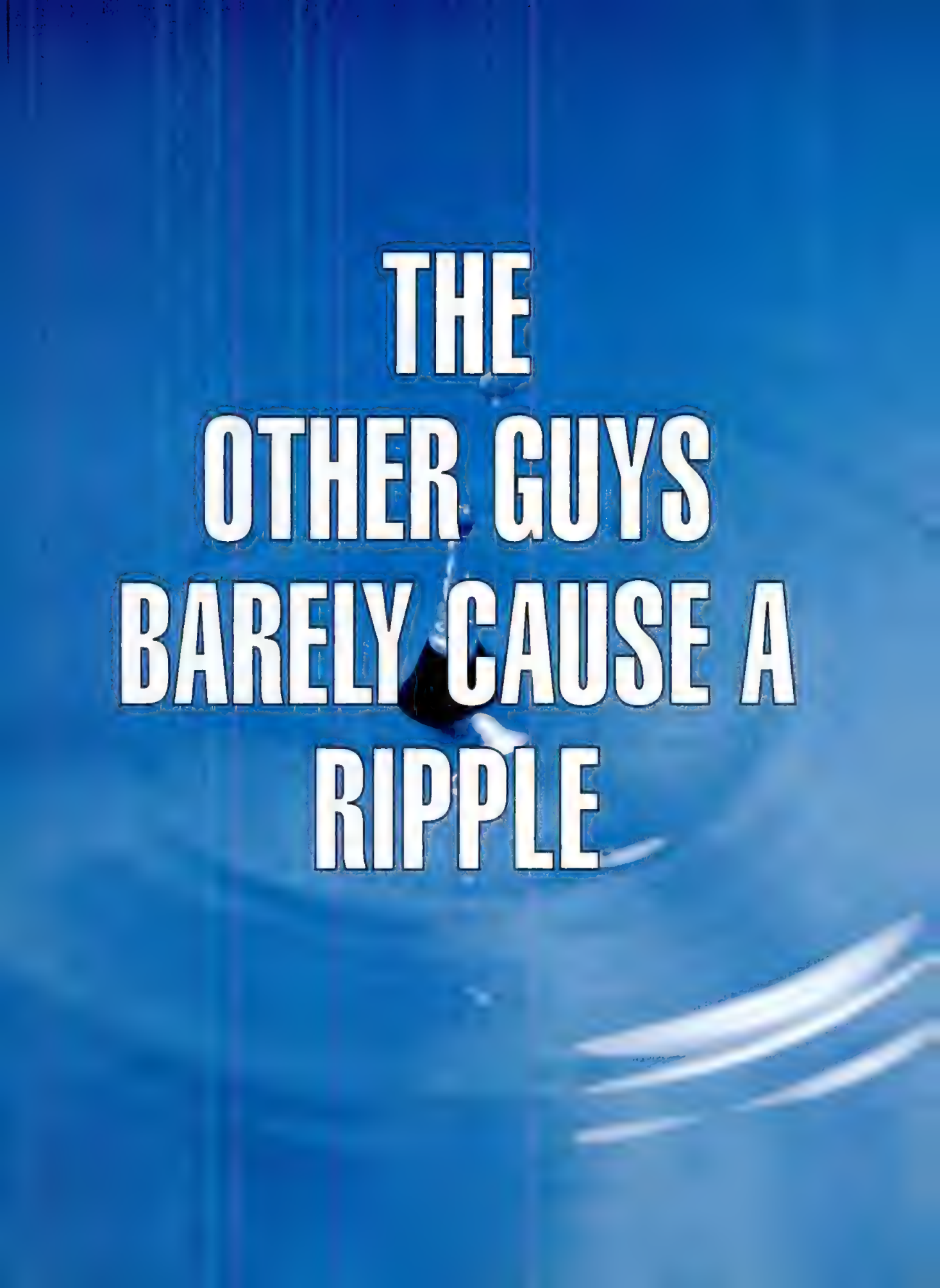
Legato NetWorker 2.2 for NetWare comes with support for managing the NetWare server-based software from any client on the network, including DOS, Unix, and Microsoft Windows clients. All the versions share a similar, Unix-based interface. But although portability is a worthy goal, Net-

SUITABILITY TO TASK

Legato NetWorker

	POOR	FAIR	GOOD	EXCELLENT
Disaster recovery	●	●	○	○
Single-file restore	●	●	○	○
Scripting and automation	●	●	●	○
Multiplatform backup	●	●	●	○

Worker's limitations are proof that this should not be the top priority in any design effort, especially one based on a Unix interface. That look and feel, which may be tolerable to Unix veterans, is NetWorker's biggest drawback. Although it performed more than adequately in our testing, the weak user interface and confusing menu

A person is in a blue pool, with their head and shoulders visible above the water. The water is a vibrant blue, and there are several white, curved ripples emanating from the person's head, suggesting a recent splash or movement. The text is overlaid on the upper half of the image.

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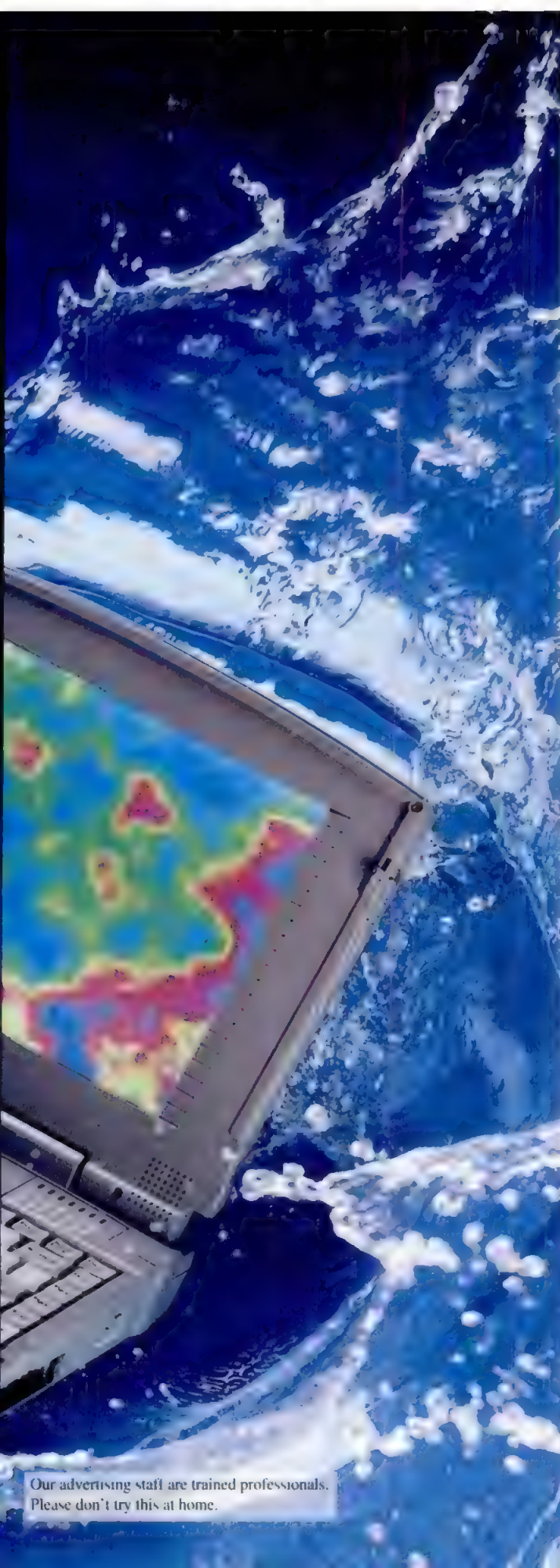
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CIRCLE 126 ON READER SERVICE CARD

Novell's Storage Middleman

By Robert P. Lipschutz

Novell Storage Management Services (SMS), a much-talked-about set of specifications, will simplify backup and restore operations in the NetWare environment. Some work remains, however, before SMS reaches its full potential.

SMS defines an architecture, implemented in software, that helps insulate backup software vendors from the NetWare operating system. SMS, an application programming interface, frees these vendors of having to write code to accommodate those files that change with each new version of NetWare. Instead, software vendors will write to the SMS specification, which allows them to back up all conceivable file systems that are supported by SMS. A file system has three parts: the files themselves; file attributes, which describe file content; and information about file location. NetWare includes many important files, including Bindery files, which hold security and trustee information, and name space files, which allow OSs other than DOS to store files on a NetWare server.

Until now, vendors have used proprietary schemes to back up the NetWare file systems. But each time a new NetWare version was released, vendors needed a long time for development, and complete success was still not ensured. When the first NetWare 3.x was released, for example, no full third-party backup solutions were available for months.

Novell has also begun a program to certify vendors' backup and re-

store software as SMS-compliant, although it is still changing SMS. What this will eventually mean to network managers is guaranteed backup and restoration of all file systems supported by SMS. No more incompatibilities and no more headaches. However, SMS creates more problems than it solves today because TSAs are in flux.

SMS supports file systems through NetWare Target Service Agents

allowing vendors to support backup of client hard disks on the network. TSAs are also being developed for database platforms. Novell wants the NetWare platform to house the backup engine for enterprise networks, and TSAs are the means of integrating varied file systems.

COMMON TAPE FORMAT

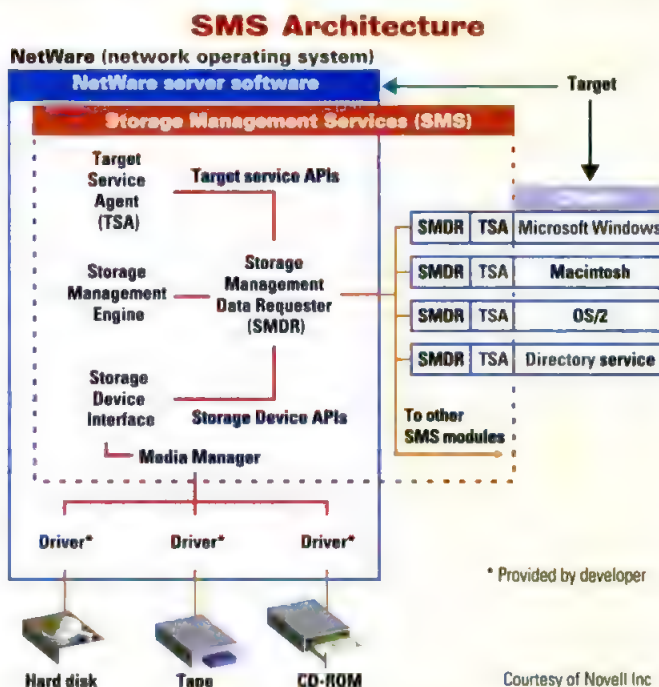
Novell is also aiding the development of the interface with the tape drive,

having fostered an industry committee to develop a tape format standard. Originally part of Novell's proprietary SMS plans, System Independent Data Format (SIDF) is now the domain of more than 20 backup software vendors. Currently, most backup software vendors use proprietary schemes when laying down data on tape. Tapes can only be read using the software that wrote the data. SIDF defines a tape format that every software vendor would use.

Currently in draft form, the SIDF proposal is slated for a vote sometime this year. Some vendors have

implemented the draft standard in products that are currently shipping. But don't count on the draft becoming a standard for quite some time, as vendors will take time to work out interoperability issues. Passage may be held up by continuing committee discussion on which standard to implement.

Since it was introduced, SMS has been hindered from broad adoption by its state of constant change and by the limited number of available TSAs. But the future looks bright for an architecture that simplifies backup and restore in the NetWare environment. □



(TSAs). TSAs interface with file systems to produce information in a common data format. The information produced by a TSA looks the same whether it came from the DOS file system or the NetWare 3.11 file system. Novell has developed TSAs for NetWare 3.11, 3.12, and 4.01, but not for 2.x. The company will release new TSAs for all new NetWare releases.

Novell is working with other vendors to develop TSAs for other environments, including Microsoft Windows 3.1 and Macintosh. TSAs are currently available for DOS and OS/2,

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F1900W	19"	0.28mm	60-85kHz	1280x1024
F1900M	19"	0.28mm	60-85kHz	1280x1024
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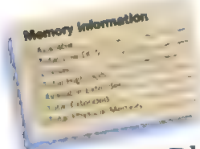
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terminology keep this package from reaching its potential.

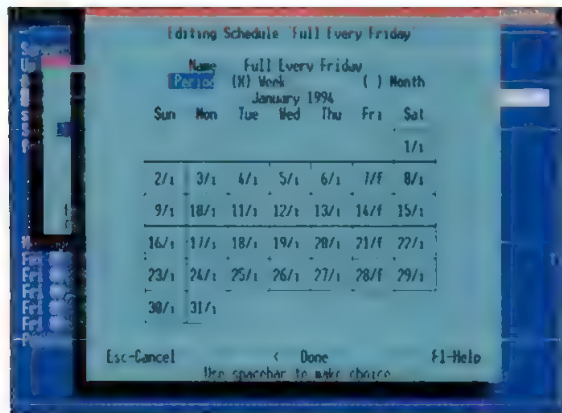
NetWorker ships with a version of Novell's SMS software, complete with versions of CLIB.NLM, SPXS.NLM, and a manual that urges you to load them. Because many versions are floating around, it is great to have a set that you know will work. Installation proceeded without a hitch.

One copy of NetWorker backs up one server, and you can manage the software from any client. On a very large network, this design will allow you to manage your overall backup procedure effectively.

The main window looks and functions like an event scheduler, with areas describing the tape drives available, the status of the jobs, and any actions or interventions required by the operator.

NetWorker's menu-driven interface was challenging to learn and use. When you are attempting to restore files to the server, for example, you cannot back out through the several recovery screens. If you escape or cancel a step, NetWorker pops you right back to the main window.

The menus are confusing as well. For example, to find what happened to a backup job, we had to go to the bottom of the operations menu and select Group Status—not very intuitive.



Legato NetWorker's interface derives from its Unix product. This approachable scheduling screen is fine, but PC users may find most of this interface rather cryptic.

Backing up a server requires a lot of configuration under NetWorker. The files to be backed up must be saved in *groups*, which consist of files, directories, and volumes on the server, as well as groups of clients. Although potentially confusing, this design allows for sophisticated backup schemes, such as backing up different

FACT FILE

Legato NetWorker 2.2 for NetWare

Legato Systems Inc., 3145 Porter Dr., Palo Alto, CA 94304; 415-812-6001; fax, 415-812-6032

List price: \$750

Requirements: Server: 286-based PC or better, 4MB RAM, 5MB hard disk space, NetWare 3.11 or later. Client: 8088-based PC or better, 1MB RAM, DOS 3.3 or later.

In short: Despite good scores in both our backup and restore tests, NetWorker is plagued by a difficult interface that is the result of Legato's valiant attempt to create a similar look across its product line. Unfortunately, it chose the Unix look and feel, and created a clumsy interface and hard-to-understand menus that will turn off all but the most tolerant network managers. Problems restoring the Bindery add to its woes.

474 ON READER SERVICE CARD

groups at different times or on different days—an essential feature for backing up large networks.

In addition to defining groups and the time of day, Legato requires you to use the schedule menu to indicate what should be done on which day. A stratified system (nine levels are available) allows you to stagger differential backups. This is effective for groups with long periods between full backups, and you might not need more than two tapes for a complete restore.

Scripting can be done through what NetWorker calls directives, which essentially are templates that control how a backup is performed. The directives screen is a mini-text editor that allows you to enter cryptic commands such as -2DASWCOMP (to turn on software compression) and SKIP *.TTS (to skip all .TTS files). Although Unix buffs

might be comfortable with this, it is archaic from a PC networking point of view.

If you've lost a server disk and need to restore it, NetWorker's recovery feature will work for you—but it didn't work for us without a problem. Although the package permits a blanket restore of the Bindery and data files all at once, this cor-

rupts trustee relationships between the files and the Bindery on the restored volume. The important thing is that we got the data back but not without slight corruption. Legato recommends that you restore the Bindery in a separate job first. If it causes errors, though, then why let the backup operator do it at all?

Overall, and against stronger contenders in this field, Legato's NetWorker has some obvious shortcomings.

Fortinet Inc.

Nsure 1.20 NLM/AllNet

BY JOHN GARRIS

Fortinet's Nsure 1.20 NLM/AllNet is surely not the answer when it comes to backing up NetWare-based LANs reliably and easily. With numerous bugs and a poor user interface, Nsure makes for a difficult backup process filled with hours of calls to technical support. We hit a lot of snags throughout our testing process, from minor user interface bugs to more serious problems that led to program failure.

Problems began to arise during installation. We had to select support for our tape drives from an available list. When we tried to have Nsure automatically detect our tape device's SCSI ID, it could not find the drive.

As we configured the client and server software, we uncovered more bugs. Sometimes when we tried to configure the server for backup, for example, Nsure would think we were configuring a client. First it thought we selected the client, then it thought we selected the server. We could not easily choose what to back up; it kept selecting the wrong drive. On two attempts, we had to go to the DOS prompt and delete two Nsure configuration files, then start the process over.

Under Nsure, backup jobs are submit-

SUITABILITY TO TASK

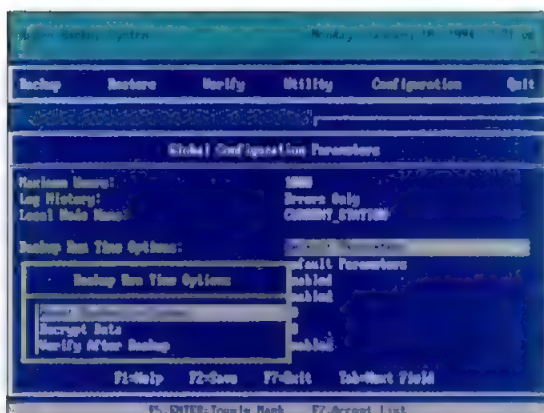
Nsure NLM/AllNet

	POOR	FAIR	GOOD	EXCELLENT
Disaster recovery	●	●	○	○
Single-file restore	●	●	○	○
Scripting and automation	●	●	○	○
Multiplatform backup	●	●	○	○

ted from a DOS workstation. These jobs are then processed by a backup engine that resides on the server, which also has a tape drive attached to it. In our testing, however, we got a number of backup errors on the server end, ranging from generic read and write errors to out-of-memory errors, even though our server had 32MB of RAM.

Fortunet representatives responded by sending a revised ASPI driver, which they said was only required for EISA-based servers with more than 16MB of RAM. We also had to make undocumented NetWare configuration changes to get Nsure to back up data properly.

The user interface did not make our job any easier. As we were configuring a backup job, a nebulous term called *current_station* kept coming back on-screen. It took a call to technical support to discover that the term always referred to the server and not to the client—an explanation, by the way,



Nsure's C-Worthy interface was one of that product's weak points, often presenting us with confusing choices and unhelpful prompts.

that contradicted the on-line help.

Many of the menu choices, such as "global configuration parameters" and "node definition" were ambiguous. At times Nsure would reject or truncate our input, and once the program incorrectly displayed a default backup setting even when an alternative setting had been selected. (Fortunet says this is the result of a

problem in C-Worthy.) All too often we had to resort to manuals or on-line help to get through confusing situations.

More problems arose when we tried to restore files. When we examined the file tree to tag specific files for restore, we found that Nsure had presorted our entire server volume before letting us maneuver through the file structure; for our 860MB data set, the presort took over 5 minutes. Furthermore, there is no way to collapse directories from the tree, so if you have an intricate directory structure, the file selection process may become cumbersome. Furthermore, when we examined the job-history logs, we noticed a number of errors involving job session numbering and directories searched.

In our testing, Nsure showed average results, taking about 1 hour 30 minutes to back up the 860MB. On the Single-File Restore test, it took just under 2 minutes—again, squarely in the middle.

We were able to perform a full disaster recovery mostly because we spent a lot of time learning the program. Separate documentation that describes the steps to

■ DAT vs. QIC

DAT's origins as a consumer product have made it inexpensive, but QIC was made for computer data.

By James Karney

How many differences can there be between digital audio tape (DAT), the tape used in our testing, and quarter-inch cartridge (QIC) tape? Both are magnetic media used to store large quantities of data inexpensively, but differences between the two technologies yield differences in their use.

DAT started out as a consumer product: The cartridges are simple and inexpensive—light plastic shells with few parts. But drives are mazes of moving parts with a complex tape path. They tend to be more expensive and complex than QIC drives. Conversely, QIC cassettes are complex: Because QIC was designed to hold computer data, the tape is in tighter alignment.

The tapes come in two sizes (3.5-inch and 5.25-inch), ranging from 120MB to 5GB. QICs run from \$16 for the 3.5-inch 120MB tapes to over \$50 for the 5GB cartridges—about twice the cost of a comparable DAT cassette. (Sizes reflect native capacities.)

QICs can transfer data at up to 1.5MB per second (MBps) compared with DAT's 0.5 MBps. Early QIC tapes took about 2 hours to format, and preformatted tapes were more expensive. Newer 5.25-inch designs format on the fly, requiring only a few seconds to create a header file. DAT tapes have never required formatting.

Since most DAT tapes are aimed at video and audio recording, vendors must perform extra testing to ensure the

reliability of cassettes destined for computer operations. This adds to the cost but is worthwhile. Make sure your tapes for network backup are certified as such: Buying a tape at a discount store may save petty cash, but it is not worth the risk. Exchanging tapes among DAT drives is tough, especially when they are from different manufacturers. QIC has some compatibility problems, too: Where a vendor uses custom compression, only its drives can read the format.

Recommendations for care are similar. Temperatures should be between 23° and 113° F. Humidity tolerance is 20 to 80 percent for QIC and 20 to 60 percent for DAT cartridges.

Organizations already committed to either DAT or QIC probably have no compelling reason to switch. Early reports of QIC's demise (because of its expense) were unfounded, and no one tape technology enjoys a permanent lead. Tape is only as good as the design that lets us put data in the pigment. And given the pressures of the burgeoning network marketplace, designs should only continue to improve. □



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LAN Backup Software



Products listed in
alphabetical order
■ = YES □ = NO

**Cheyenne
Software Inc.**
**ARCserve for
NetWare—
Windows
Edition**

Palindrome Corp.
Backup Director

**Conner Storage
Systems**
**Backup Exec
for NetWare**

**Mountain Network
Solutions Inc.**
**FileSafe
for Windows
Rescue NLM**

**Legato Systems
Inc.**
**Legato
NetWorker
for NetWare**

Fortinet Inc.
**Nsure
NLM/AllNet**

**Performance
Technology Inc.**
**PowerSave
for Novell**

**Systems
Enhancement Corp.**
**Total Network
Recall**

**Emerald Systems
Corp.**
Xpress Librarian

General

Reviewed version	5.0	2.1	4.0	1.0	2.2	1.20	3.10	1.70	3.0
List price	\$395–\$9,295	\$795	\$995	\$99–\$499	\$750	\$885	\$995	\$349–\$799	\$595
Has Windows client front end	■	□	■	■	□	□	□	□	■
Has DOS client front end	□	■	■	□	■	■	■	■	□
Server- or workstation-based	Server	Server	Server	Server	Server	Server	Workstation	Server	Workstation
Can autodiscover tape hardware and firmware	□ (select from list)	■	■	■	■	□ (select from list)	□ (select from list)	■	□ (select from list)

Software Features

Backup:

Attended	■	■	■	■	■	■	■	■	■
Unattended, scheduled	■	■	■	■	■	■	■	■	■
Incremental	■	■	■	■	■	■	■	■	■
Differential	■	■	■	■	■	■	■	■	■
Backup operator can tag specific files	■	■	■	□	■	■	■	■	■
Directory	■	■	■	■	■	■	■	■	■
Can use wildcard characters	■	■	■	■	■	■	■	■	■
Backs up hidden files	■	■	■	■	■	■	■	■	■
Retries open files	■	■	■	■	□	■	□	□	■
Verify option	■	■	■	■	■	■	■	■	■
Tape-rotation scheme	■	■	□	■	■	□	■	□	□
Error log	■	■	■	■	■	■	■	■	■
Preflight for sufficient space	■	■	□	□	□	□	□	□	□
Multiple volumes	■	■	■	■	■	■	■	■	■
Multiple NetWare servers	■	■	■	■	■	■	■	■	■
File grooming	■	□	■	□	□	□	□	■	■

Restore:

Creates index	■	■	■	■	■	■	■	□	■
Finds all instances of a single file across multiple tapes in a single search	■	■	□	■	■	□	■	■	■
Backup operator can tag specific files	■	■	■	■	■	■	■	■	■
Directory	■	■	■	■	■	■	■	■	■
Can use wildcard characters	■	■	■	■	■	■	■	■	■
Restores hidden files	■	■	■	■	■	■	■	■	■
Client user can restore own files	■	■	■	□	■	□	□	□	■
Redirection (drive and name)	■	■	■	■	■	■	■	□	■

Backup Media Supported

4 mm (DAT)	■	■	■	■	■	■	■	■	■
8 mm	■	■	■	■	■	■	■	■	■
QIC	■	■	■	■	■	■	■	■	■
Magneto-optical (writable)	■	□	□	□	□	□	□	□	□

► **S U M M A R Y O F F E A T U R E S**

ENDS



Products listed in
alphabetical order
■ = YES □ = NO

Cheyenne
Software Inc.
**ARCserve for
NetWare—
Windows
Edition**

Palindrome Corp.
Backup Director

Conner Storage
Systems
**Backup Exec
for NetWare**

Mountain Network
Solutions Inc.
**FileSafe
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Rescue NLM**

Legato Systems
Inc.
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Fortinet Inc.
**Nsure
NLM/AllNet**

Performance
Technology Inc.
**PowerSave
for Novell**

Systems
Enhancement Corp.
**Total Network
Recall**

Emerald Systems
Corp.
Xpress Librarian

Compression Support

Software compression	□	□	□	□	■	□	■	□	□
User can disable compression	N/A	N/A	N/A	N/A	■	N/A	■	N/A	N/A
User can disable hardware compression	■	□	□	■	□	■	■	□	□

Backing Up Different Platforms

NetWare 2.x	■	■	□	□	□	■	■	□	■
NetWare 3.11, including Bindery	■	■	■	■	■	■	■	■	■
NetWare 3.12, including Bindery	■	■	■	■	■	■	■	■	■
NetWare 4.01, including NDS	■ (NDS through Bindery emulation)	■ (through free separate utility)	■	■	□	□	□	■	■
Pathworks	□	□	□	□	□	□	□	□	□
VINES	□	□	□	□	□	□	■	□	□
Windows NT	■	□	Optional (\$349)	□	□	□	□	□	□
SMS 2.0 support	■	□	■	■	■	□	□	■	■
Can use NetWare 3.12 TSA to back up server	■	□	■	■	■	□	□	■	■

Name-Space Support

Backs up name spaces on server for:

FTAM files	■	□	■	■	■	□	□	■	■
Macintosh files	■	■	■	■	■	■	■	■	■
NFS files	■	□	■	■	■	□	□	■	□
OS/2 files	■	□	■	■	■	□	□	■	■

Client Backup

DOS/Windows	■	Optional (\$695)*	■	□	■	■	■	■	Optional (\$495)
Log-on required for DOS-client backup	□	□	□	N/A	□	□	□	□	■
Macintosh	Optional (\$495)	□	■	□	□	□	□	□	□
OS/2	■	Optional (\$695)*	■	□	■	□	□	■	□
Unix	Optional (\$496-\$695)	□	■	□	■	□	□	□	□
Windows NT	■	□	□	□	□	□	□	□	□

Security

Data encryption	□	□	□	□	□	■	□	□	■
Media password protection	■	■	□	■	■	■	■	■	■

Technical Support

BBS	■	■	■	■	■	■	■	□	■
Fax-back support	■	■	■	■	□	□	□	□	■
Telephone support hours (eastern time)	8:00-10:00 M-F, 10:00-4:00 Sat., Sun.	9:00-8:00 M-F	8:30-8:00 M-F	10:00-8:00 M-F	9:00-9:00 M-F	10:00-8:00 M-F	10:00-6:00 M-F	7:00-6:00 M-F	9:30-8:00 M-F
Toll-free telephone support	■	□	■	□	□	■	□	□	■
Duration of free technical support	Unlimited	Unlimited	Unlimited	Unlimited	Six months	Unlimited	Unlimited	Unlimited	Unlimited

N/A—Not applicable: The product does not have this feature

* Backup for both DOS/Windows and OS/2 clients is available in a single package for \$695.

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FACT FILE

Nsure 1.20 NLM/AllNet

Fortinet Inc., 1111 Brickyard Rd., Suite
202, Salt Lake City, UT 84016;
801-467-6887; fax, 801-467-7090.

List price: Workstation-based products: Personal, \$49, OneNet, \$175, MidNet, \$295, AllNet, \$595 Server-based products: NLM/OneNet, \$195, NLM/MidNet, \$395, NLM/AllNet, \$895

Requirements: Server: 386-based PC or better, 2MB RAM, 2MB hard disk space, NetWare 3.1x or later, tape drive adapter card with ASPI driver. Client: 286-based PC or better, 512KB RAM, 160K hard disk space, DOS 3.1 or later

In short: Installation problems, a list of bugs, and an overly complex interface combine to make Nsure a poor choice. And it would also often present unfounded error messages. Add to all that average scores and a shaky restore function, and you are better advised to wait on a new version of this product

475 ON READER SERVICE CARD

take for disaster recovery was not included, and the poor interface only made the process more difficult.

In its favor and unlike many backup packages, Nsure can back up NetWare 2.x servers, and the single-server backup package is fairly inexpensive.

Performance Technology Inc.

PowerSave, Version 3.10, for Novell

BY KEN MACKIN

A mature, flexible backup package, PowerSave, Version 3.10, for Novell can see

and back up any server on the network without special NLMs or SMS software. A champion at restoring DOS files, PowerSave is intelligently designed, with a DOS interface. It does have a

rather limited tape-naming scheme, but this is a good choice for small networks and many larger multiserver networks.

PowerSave runs from a node on the network—one of only two tested products

to do so—and backs up a server, a network of servers, and all associated DOS- and Mac-based clients to that node, which is designated as the tape station. It does not support OS/2 or Unix clients.

You can designate your supervisor station as the tape station, providing no SCSI drivers are booting from the CONFIG.SYS file. These drivers could conflict with PowerSave, which provides ASPI drivers that will work with its software. This means you cannot run another SCSI device from the management station.

Once we overcame the problem, installing and running the product proceeded without a hitch. The single Adaptec SCSI card and HP JetStore 5000E tape drive were recognized, and all appropriate drivers were installed and configured. When PowerSave boots, it runs a check of the current SCSI environment to see if a valid tape drive or SCSI bus is available.

The interface, although DOS-based, is easy to use, with pull-down menus and mouse support. A Windows version is planned for release by the time you read this review.

PowerSave's backup scheduler is based on a 28-day revolving cycle. For each day, you can choose the tape name and select a full, incremental, or differential backup. You can also select a tape-append flag to force PowerSave to skip over existing data on the tape before writing.

We found PowerSave's tape-naming scheme somewhat confusing. Instead of

urging you to create your own tape names, PowerSave defaults to the days of the week. Because the 28-day schedule looks like a calendar, you are not aware that

are actually the tape names. This becomes a problem when you want to reuse a tape that has a different day written to the tape label. You need to remove the old label with a quick erase.

PowerSave's Backup Schedule Questionnaire automates the creation of a backup script using a question-and-answer format; you simply point and click on the objects to be backed up. The script can then be edited using any text editor.

When you select a directory to include

Tape Activity Reporter						
Event	Tape	Date	Time	Script	Retries	Err
Validate End		11/19/93	09:15:39		3	0
Save Start	PHI	11/19/93	09:21:12	2CD00004	0	
Save Start	PHI	11/19/93	11:32:19	2CD01727	0	
Validate End	PHI	11/19/93	12:29:36		0	894
Save Start	SAT	11/20/93	14:35:35	2CD00004	0	
Validate End	SAT	11/20/93	14:30:13		0	0

Count: Validate End	Tape: SAT	Date: 11/20/93	Time: 14:30:13
Script:	Retries:	Error:	Size:
Append: No	Tape ID: 7C303003		

PowerSave's Tape Activity Reporter keeps you informed of your backup's progress on a tape-to-tape basis.

and press the Right Arrow key or click the mouse, the directory is opened and the cursor is positioned in the middle of the directory, as opposed to the top. It is a small but surprisingly worthwhile feature; in our testing, we had more than 26,000 files on the backup schedule. With that many files, having the cursor appear in the middle of the directory saved us a lot of

FACT FILE

PowerSave, Version 3.10, for Novell

Performance Technology Inc., 800 Lincoln Center, 7800 IH-10 West, San Antonio, TX 78230-4750; 800-327-8526, 210-349-2000; fax, 210-366-0123.

List price: for NetWare, \$995, for VINES, \$1,995, for POWERLan \$199

Requirements: Server: none. Client: 286-based PC or better, 450K RAM, 2MB hard disk space, DOS 3.3 or later

In short: PowerSave is a rising star among backup products. It features excellent hardware support, a friendly and sensible interface with top-notch, context-sensitive on-line help. The program requires no special software to run on the servers it backs up. The program's limitations include a somewhat rigid backup scheduling scheme, no file grooming, and a separate utility for accessing formats, erasures, and adjusting tape tension

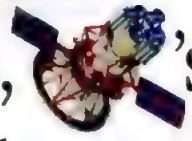
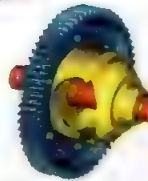
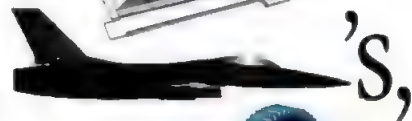
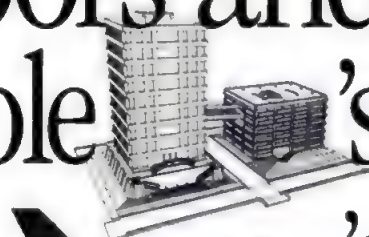
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SUITABILITY TO TASK

PowerSave

	POOR	FAIR	GOOD	EXCELLENT
Disaster recovery	●	●	●	○
Single-file restore	●	●	○	○
Scripting and automation	●	●	●	○
Multipatform backup	●	●	●	○

Yes,
 you can do Windows™
 and walls and doors and
 floors, ceilings, whole 's,
 's, trains, boats, 's,
 chains, 's, diamond rings, 's
 and things, 's, power plants, topo maps,
 's, helicopters, roads
 and bridges, circuit boards, 's
 power lines, 's, airports, furniture,
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 's, chemical plants, 's, golf courses,
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CIRCLE 048 ON READER SERVICE CARD

time, because basically you are cutting the distance to any file in half.

With all backup transactions taking place over the network cable, PowerSave is about 20 percent slower than the server-based backup solutions—on an 860MB partition, amounting to slightly less than 15 minutes. But the server versus tape-station argument becomes moot when multiple servers and clients are involved; in either case you have to go over the wire, and the server-based solutions lose their advantage.

Restoring with PowerSave is the mirror image of the backup process. The Restore Navigator feature lets you select the node to be restored and the files to be included. Its linked-list database knew the location of all the 860MB of files on our tape and was second only to ARCserve in its performance numbers for finding and restoring single files.

Systems Enhancement Corp.

Total Network Recall, Version 1.70

BY KEN MACKIN

A newcomer to the network backup market, Systems Enhancement Corp.'s Total Network Recall (TNR), Version 1.70, lacks a critical aspect of any backup soft-

SUITABILITY TO TASK				
Total Network Recall				
	POOR	FAIR	GOOD	EXCELLENT
Disaster recovery	●	○	○	○
Single-file restore	●	○	○	○
Scripting and automation	●	●	○	○
Multiplatform backup	●	●	○	○

ware: a credible restore function. TNR left us with no confidence that our data could be restored.

Using TNR begins auspiciously enough with a friendly and easy-to-use client-based install utility. It correctly warns you when it detects a newer version of any of the particular NLMs it uses (such as TSA312) and asks you if you want to overwrite. The install program then loads TNR.NCF, which initializes the server. After that, though, the process breaks down.

The install program does not handle the entire procedure; instead, the manual instructs you to update your AUTOEXEC.NCF file manually to include certain drivers. You must then reboot. Unfortunately, the information was wrong: The program aborted several times. Only by painstakingly installing each driver on the install disks in various sequences were we able to determine the actual drivers we needed and the order in which they belonged. It took well over an hour.

But the first hint of the ultimately fatal troubles we experienced with TNR did not appear until we tried to restore our 860MB data set onto a new SYS drive. With the TNR database (formerly located on our old system drive) gone, our only choice was to restore all data from tape.

The manual lists two ways to do this: a quick restore for specific files, which works, and a restore by backup set, which relies on the information in the TNR database. You must use the Restore History files function to recover the TNR database before restoring any other information. Unfortunately, this was not covered in the text of the manual (note, too, that we repeatedly asked for any updated manuals—even if not in final form—and never received any). But there turned out to be a good reason for that: The product as tested simply does not support restoration of server data from tape. Unbelievable, but true.

Initially, Systems Enhancement's response to our reports of trouble was to suggest that because TNR is an SMS-based product, users could run NetWare 4.01's SBACKUP product to recover the data. But,

FACT FILE

Total Network Recall, Version 1.70

Systems Enhancement Corp., 11605 Lilbrun Park Rd., St. Louis, MO 63146-3535; 314-997-7717; fax, 314-997-1501.

List price: Up to 10 users, \$349, up to 50 users, \$499, up to 1000 users, \$799

Requirements: Server: 386-based PC or better, 8MB RAM, 2MB hard disk space, NetWare 3.11 or later
Client: None

In short: Its installation is, at best, troublesome and confusing, requiring you to make manual changes to startup files that did not work. More importantly, the version we tested could not perform a full restore on our data set—a fatal flaw for a backup software package. (Systems Enhancements has issued a new version since our testing that was not ready in time for formal review.)

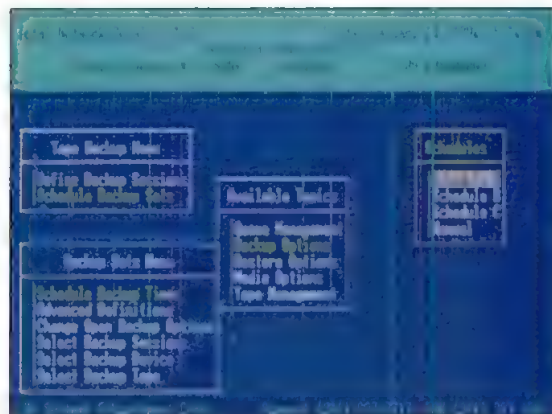


ON READER SERVICE CARD

among other things, that automatically means that the much larger group of NetWare 3.x installations are out of luck. Finally, in response to our discoveries, Systems Enhancements gave us a new version—1.80—that included a working restore-from-tape function. It could not be formally tested in time for this review because of the same installation problems noted previously and because it was received too late in the process.

TNR does a few things correctly. Its server-based database keeps track of constantly changing file information across the network, separating DOS, OS/2, and Macintosh name spaces. In our backup tests, it scored about average; on the Single-File Restore test, however, it was by far the slowest of the products, taking more than 3 minutes longer than the next slowest, Emerald's Xpress Librarian.

The package's interface is similar to the C-Worthy look found in most NetWare utilities. And TNR has a feature no other product tested here has: the ability to control CPU utilization by the backup process. This function forces TNR to give control back to NetWare, which can then share CPU time with



Total Network Recall's C-Worthy interface maintains the look and feel of a Novell-supplied utility.

Network Backup

other processes.

Total Network Recall was designed for NetWare 4.01. Systems Enhancements says that it has shipped several hundred copies, mostly for NetWare 4.01. If you are using this product, do yourself a favor and attempt a total restore from tape to see if it actually works. Our experience with TNR in the release we reviewed left us with no choice but to recommend against it. We hope version 1.80 will address some of its problems.

Emerald Systems Corp.

Xpress Librarian, Version 3.0

BY PADRAIC BOYLE

For a network backup product that's easy to use, inexpensive, and includes features usually found in more expensive packages, consider Emerald System

SUITABILITY TO TASK

Xpress Librarian

	POOR	FAIR	GOOD	EXCELLENT
Disaster recovery	●	●	○	○
Single-file restore	●	●	●	○
Scripting and automation	●	●	●	○
Multiplatform backup	●	●	●	○

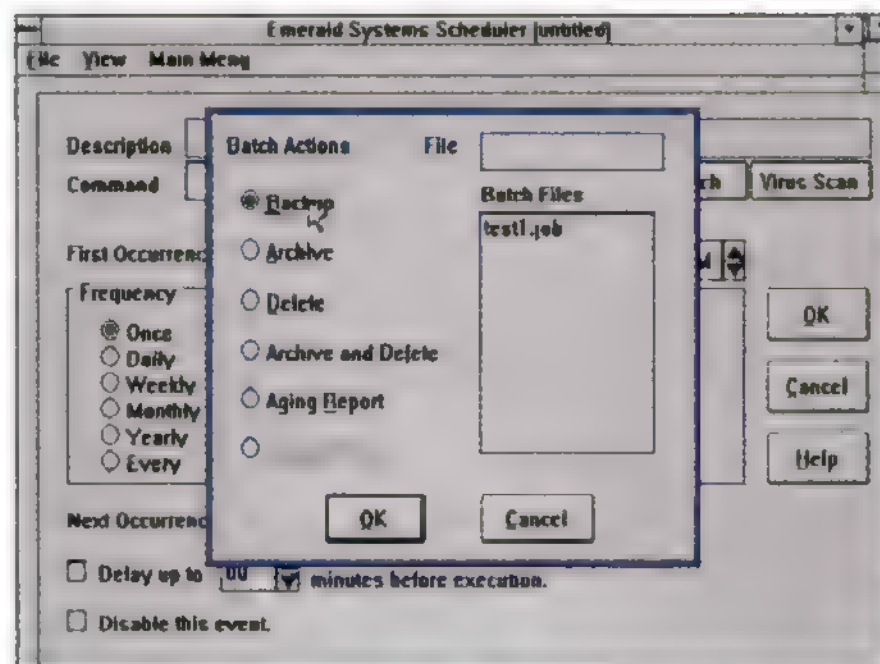
Corp.'s \$595 Xpress Librarian, Version 3.0. It boasts support for NetWare 4.01's NetWare Directory Services (NDS), and, with a \$495 add-in module, use of an autoloader tape carousel. However, it has limited hardware compatibility, supporting only the HP JetStore and its own tape drive. Also, it does not back up Macintosh, OS/2, or Unix clients, although it will back up Mac files from the server.

You install Xpress Librarian and a tape drive at a client system. You only need a single, Novell-supplied NLM on a NetWare 4.x server if you want to back up the NDS; if it isn't loaded, the program will take care of that. We found installation easy to follow, although we were required to install the appropriate drivers manually for the Adaptec SCSI adapter before the software would recognize it. Because there is no need to load anything onto the servers, we were ready to go right after installation.

Three programs constitute Xpress Librarian: the Backup Engine, the Scheduler, and the Librarian. All three sport easy-to-use Windows interfaces. The Backup Engine allows you to choose one or many servers. You navigate volumes, directories, and files with a mouse, choosing what you wish to back up. If you want to use a script more than once, you can save it as a batch job and execute it whenever needed. These batch jobs can also be launched in an unattended mode using the Scheduler.

The Librarian, perhaps the most powerful program of the three, lets you search through the database intuitively to assist in the restore process. The front end is very similar to that of the Backup Engine, enhancing the product's ease of use. You can search for files by specific criteria such as user name, date, or the age of the file, or through the directory tree structure. Security built into Librarian allows the administrator to limit who can groom disks and remove tapes.

Xpress Librarian's database resides on the local hard disk of the backup client. This could pose a problem if the drive crashes, so you should back up the hard disk every night to ensure database integrity. (This differs from other systems that back up the database automatically;



Xpress Librarian's Scheduler is a powerful, easy-to-use tool for scheduling and running backup procedures.

they arrange that the latest tape will also always have the most up-to-date copy of the database.)

Xpress Librarian backs up DOS clients remotely using an included TSR licensed from Fresh Technologies and loaded on those PCs. It treats the client as if it were a server on the network, and the information is stored in the Librarian. But this feature is only available for DOS/Windows clients.

The Scheduler is a standalone application that automates Xpress Librarian. You can configure it to perform procedures automatically at a scheduled time, and many tasks, such as backup, disk grooming, and generation of file-aging reports, can be run at user-defined frequencies. You can also schedule any executable file or Windows commands to be run at a predetermined time.

Emerald makes two other backup products: EmSave and the soon-to-be-released Xpress Serve. EmSave provides the same functionality as Xpress Librarian, but without the Librarian program. Xpress Serve, which has a C-Worthy interface instead of Windows, is due to ship by the time this review is published. It is a server-based backup solution designed to deliver better performance by moving the tape drive and the software from the client to the server.

Xpress Librarian's support for SMS and NDS, combined with its ease of use, low price, and high-end features, make it a good choice for DOS-based networks. It's worth a good look—if you don't need support for Macintosh, OS/2, or Unix clients. □

FACT FILE

Xpress Librarian, Version 3.0

Emerald Systems Corp., 12230 World Trade Dr., San Diego, CA 92128; 800-767-2587, 619-673-2161; fax, 619-673-2288.

List price: Xpress Librarian, \$595; autoloader module, \$495; peer-to-peer module, \$495.

Requirements: Server: NetWare 2.15 or later. Client: 2.5MB hard disk space, Windows 3.0 or later (or Windows for Workgroups), Emerald or Adaptec SCSI adapter.

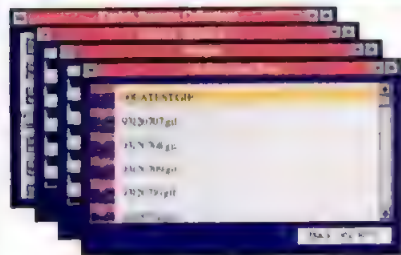
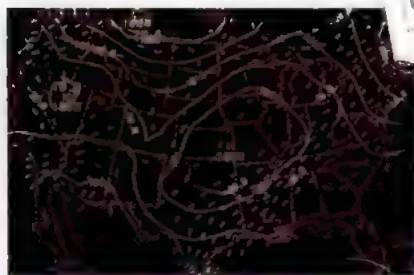
In short: Ease of use, price, and flexibility are among some of the more attractive features offered by Xpress Librarian. For its price it offers some features found in more expensive products, but it lacks support for a wide variety of hardware such as SCSI adapters and tape drives.

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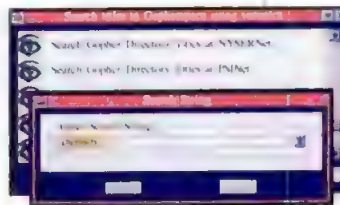
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Compatible with Other Windows Applications

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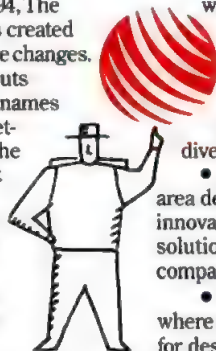
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Network Edition

THE LATEST NETWORK PRODUCTS AND MANAGEMENT TECHNIQUES

ECC MEMORY:

The Cure for Server Amnesia

Error correction code memory corrects undetectable errors when they occur. Should you be looking at it for your server?

by Frank J. Derfler, Jr.

No matter what your business provides, your data is crucial to your business. Yet as the data your computer uses—everything from program code to spreadsheet numbers—passes between disk storage, processor, and RAM, it's vulnerable to corruption by forces inside and outside the computer. Any change can, under the best conditions, bring processing to a screeching halt or, under the worst, introduce virtually undetectable errors into your company's records.

Concerned? You should be. But rest

assured that with the adoption of error correction code (ECC) memory, a few server, tape backup, and hard disk manufacturers are starting to provide the kind of reliability that was once associated with mainframes. On the bottom line, ECC

memory detects and corrects data errors on the fly and then tells you about them later. The detection part is easy, but the correction part is hard because it requires deriving correct data from corrupted data. To accomplish this, ECC memory uses a checksum.

Since the memory has to store this checksum and provide the logic for interpreting it, ECC costs more than it is probably worth in 486-based computers, but it is a tremendous and practically free benefit in Pentium-based machines. And ECC also provides value in computers powered by several models of processors from Digital, IBM, PowerPC, and Sun.

As more Windows NT and NetWare servers start to use Pentium, Alpha, PowerPC, and SPARC processors, the presence of ECC is becoming an important part of the server buying decision. ECC is most valuable when it is linked to a management system for reporting errors. But ECC is useful in any computer that uses large blocks of RAM and a fast processor.

HOW BIG IS THE PROBLEM?

Vendors of computer systems agree that the types of data storage errors caught and corrected by ECC, those in memory

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To Work

digital

Two Ways to More Accurate Data

The common parity check and the more sophisticated error-correction-code (ECC) check have some techniques in common, but ECC can correct errors as well as detect them.

Parity generators create one additional bit for each data word, making the total number of 1-bits in the data word, including the parity bit, come out either always even or always odd, depending on the type of parity used in the computer architecture. The parity bit is stored with the data word, and another parity bit is computed the next time the word is read. If the two bits don't agree, the computer halts.

ECC generators compute a five-bit ECC number by a technique called *Hamming code*, which records each individual bit value three

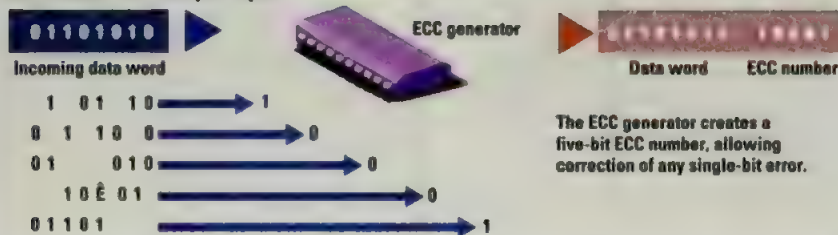
times. This gives the processor a method of correcting an error in just one bit while detecting an error in any two or more bits. (Some two-bit error conditions can fool parity checking.)

When the data word is read from memory, the ECC processor computes a new ECC value, performs an exclusive check of the two values, and senses the presence of any 1-bits. A simple lookup table with 13 alternatives, each containing either one or three 1-bits, tells the processor which bit to change and how to change it if there is an error. If there is a two-bit error, the result will contain either two or four 1-bits, and the ECC processor will send an alarm to the main processor.

Parity adds one bit per byte.



ECC adds five bits per byte.



and on tape, are not the biggest source of malfunctions in servers. Hard disks top every vendor's list of server problem items, followed by power and cabling problems that are often external to the computer. However, when data integrity is crucial, memory problems must be solved. ECC memory provides a useful way to handle these problems.

We talked to experts in computer architecture and design at Compaq, Distributed Processing Technology, Digital Equipment Corp., Hewlett-Packard, and IBM and asked them about the scope of the problems that ECC technology can solve. In general, their answer was that the more you use the computer the more you need ECC. The industry offers DRAM (dynamic RAM) chips, which typically experience one

error in a million hours of operation. That might sound like a pittance, but depending on the machine configuration, an error could occur far more frequently, explained Don Smelser, a consulting computer hardware engineer at Digital Equipment Corp. "Let's say you have a server with 256MB of memory representing perhaps 500 DRAM chips that runs 24 hours a day. That's an error every three months or so," he said.

Of course, average failure rates operate over a normal curve, and your computer might be anything but normal. If you are betting your business on your server, then you want the intervals between downtime measured in terms of years, not months. If you need reliability at this level, then you need ECC. But what is it?

HOW DOES ECC WORK?

ECC is rooted in mathematics; polynomials, to be exact. As each data word, typically an eight-bit or longer block, passes into storage, a processor mathematically derives an ECC number to be used as a checksum from the contents of the data word and tacks the code onto the end of the word. Then, when the word is read from storage, the processor checks the appended ECC number against a newly computed sum. The type of processor and the ECC formula it uses depend on whether the storage is on tape, on disk, in cache, or in RAM.

Those of you familiar with parity checking will recognize the concept of a checksum—computing a sum from a data word to catch an error. Parity checking systems typically count the number of 1 bits in a byte and then tack on either a 0 bit or a 1 bit so that a count of the total number of 1 bits, including the parity bit, is an even number. Anyone who has set up a serial port knows that odd parity—adding a bit so that the sum of all the 1 bits is an odd number—is also an option in those systems.

In communications software and in other products such as tape backup software, a parity error will generate a retry. But there is no way to retry memory access, so the parity detector is connected to the processor's nonmaskable interrupt (NMI) pin, which can halt the processor. An incorrect parity sum in memory generates the dreaded NMI error, and everything stops. (By the way, not all NMI errors are memory errors.) But halting the system at an indication of a parity error isn't acceptable when businesses run their critical applications from network servers.

Also, the relatively simple parity system can be fooled by an error that changes, for example, a 1 bit to a 0 bit and vice-versa in the same byte because the total number of 1 bits will be the same even though the data word is wrong.

ECC computations find and correct errors without halting the system. The ECC processor performs binary addition of specific bits in the data word and repeats the process using different bits or combinations of the same bits. The result-



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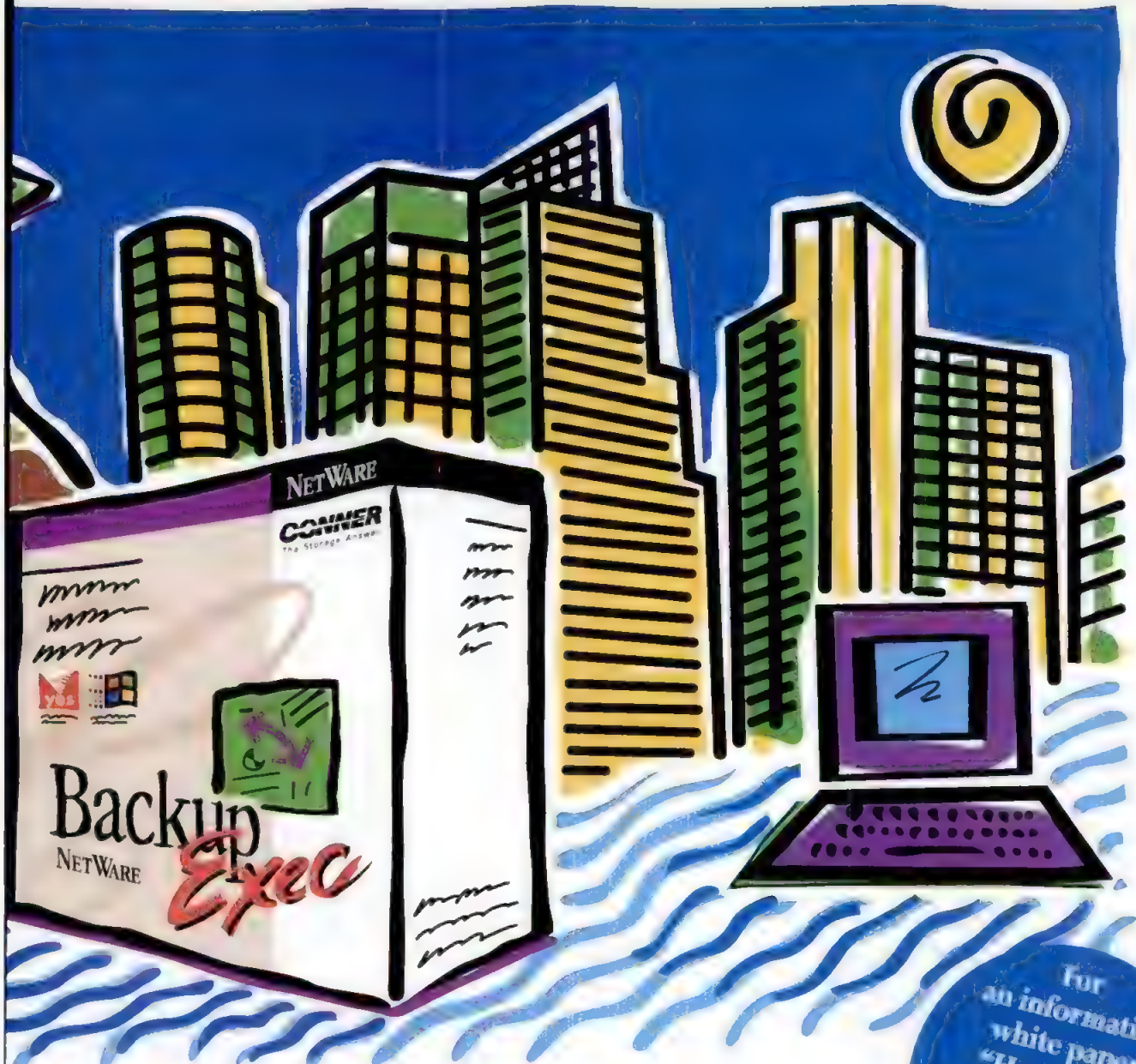
Backup Exec supports NetWare 3.x and 4.x, as well as LAN Manager®, LAN Server®, and Lotus Notes® servers. It also protects virtually every type of workstation that can be attached to a Novell NetWare server. Including DOS®,

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Features	Backup Exec for NetWare 4.x	Cheyenne ARCserve 4.x	Cheyenne ARCserve 5.x
Ensures complete NetWare backup by automatically installing Novell's SMS components on all protected servers	YES	NO	NO
Protects NetWare servers and DOS, Windows, & OS/2 Workstations	YES	YES	YES
Protects UNIX and Apple Macintosh Workstations	YES	\$Option	\$Option
Integrates support for LAN Manager and LAN Server Access Control Lists (ACL's)	YES	NO	NO
Maintains network security by preserving access and restore privileges when viewing the tape catalog database	YES	NO	NO
Enhances flexibility by allowing all operations from the server console	YES	NO	NO
Provides both interactive DOS and Windows GUI interfaces	YES	DOS only	Windows only



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Hardware Inventory	Yes	Yes	Yes
Software Inventory	Yes	Yes	Yes
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Printer Management	Yes	No	Yes
Disk Monitoring	Yes	No	Yes
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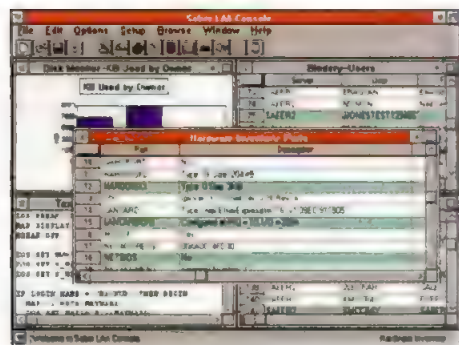
more ease of use, more flexibility and versatility than the others.

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CIRCLE 856 ON READER SERVICE CARD

TECHNOLOGY SPOTLIGHT

ing addition to the data word is not a single parity bit; its exact length depends on the length of the data word and the size of the errors you want to catch, and it contains much more information. The ECC processor computes the ECC value of a newly read data word and loads both the new ECC value and the old value stored with the word into a few gates that make up a device called a *comparator*. The comparator should come up with a match, represented by a string of 0 bits. If the result contains any 1 bits, the positions of those bits tell the processor which segment of the word to correct and how to correct it.

The ability to both detect and correct errors in data words makes ECC valuable. But when is data at risk, and what does it cost to protect the data? Those are questions that savvy network managers should ask. Unfortunately, the answer you get depends on who you ask and where you focus in the computer system.

SOURCES OF ERRORS

What is the enemy of good data? What happens to change a good data word into a garble? The villains clearly include DRAM chips, electrical noise in the computer, and (possibly) alpha particles. The effects of the villains are amplified by more active operating systems. Most of the computer designers agree that the so-called "soft" or transient errors caused by chip problems, electrical noise, and alpha particles will, in the words of one IBM engineer, "affect only one bit in 900, and 99 times out of 100."

DRAM chips are, in terms of fabrication and design, the cutting-edge semiconductors of the computer industry. They are a point of intense competition in the industry, and the vendors invest in a constant chain of new developments. But people who buy cutting-edge technology can bleed from the results. Some DRAM designs or manufacturing processes are less than perfect, and all designs do not operate with exactly the same timing during reads and writes. The errors these chips can produce range from simple mechanical failures to complex timing problems. ECC is a small bandage for certain types of problems caused by the memory chips.

Electrical noise inside the computer

can disrupt data at any place in the system. Some pulses and spikes have external sources such as improper grounding of AC power wiring. Other electrical noises come from poorly designed or fabricated adapters and cards. (Note that FCC approval has nothing to do with this kind of electrical noise. The FCC only cares about radiation *outside* the cabinet; its tests don't measure what goes on *inside*.)

If you were only a few microns high (a micron is about 1/200 of the thickness of a human hair) and you lived on a memory chip, then an *alpha particle* (the nucleus of a hydrogen atom containing two protons and two neutrons) would look, upon its creation, like a cannonball shooting towards you. The alpha particle cannonball comes from the decay of impurities inside the material used to make the chip and its carrier. When it is created, the alpha particle can break loose electrons and other particles that create havoc with the data stored as electrical charges in your memory chip.

The group of experts we talked to was divided in their opinions on the subject. Some laughed at the concept, saying they are no longer a problem because the impurities in the chip-manufacturing process have been rectified, while others said that alpha particles from within the chip remain a real problem. The theory holds that the data is particularly vulnerable to damage when an alpha particle hits a chip's read line during the read cycle. If you have a lot of read cycles, then alpha particles become a bigger problem—which might explain the differences in opinions among the experts.

While some people blame memory problems on sunspots and cosmic rays, energy from space isn't credited as a threat by the designers of computer systems. It is theoretically possible that a cosmic ray could hit a hydrogen atom in the chip and generate an alpha particle that could affect the stored data, but that is an unlikely chain of events.

If alpha particles are the problem, then adding more memory will reduce the odds that a hit on one particular read line will take place during a read cycle. But adding more memory to the system can have unpredictable effects: If bad chip design

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or fabrication is causing a problem, then adding more bad chips makes things worse. If electrical noise is a problem, then the level of errors will be about the same regardless of the number of chips because the noise is constant.

WHO IS AFFECTED?

Fast and active computers suffer more memory problems because they read from and write to memory more often and at greater speeds. Modern operating systems use pages of memory and internal caches, so they will move a data word many times during its processing. The heavy level of reading and writing activity increases the overall odds of error. The computer designers we talked to emphasized timing and compatibility problems when third-party RAM products (those not installed or approved by the manufacturer) run in a high-speed computer with high levels of read and write activity. Compaq also cites non-Compaq EISA bus-mastering adapters that have less than perfect timing and can create problems when they are writing to memory.

All of the vendors except Compaq and to some extent Digital Equipment Corp. feel that it is adequate to be able to detect errors in any two bits in a data word and to be able to correct an error of one bit. Errors of two bits are treated as if they were parity errors, generating an NMI error.

The designers at Compaq argued that since most computer systems use single in-line memory modules (SIMMs) with four-bit DRAM architectures, four-bit failure due to poor mechanical fabrication is an increasingly common problem. Therefore, Compaq uses an evolved system of polynomials, which they are moving to protect with a patent action, that both detects and corrects four-bit errors. That four-bit architecture does not, however, provide a 100 percent guarantee of correction of two-bit and three-bit errors.

The designers at Digital see both sides. Digital's largest computers used a technique called *bit scattering* to build a bul-

leproof ECC system. This system does elaborate ECC checks that span groups of semiconductors. Only a single bit from any one DRAM is read into each ECC block. Through repeated comparisons of all ECC numbers with a single bad chip in common, the ECC generator can track down and correct all errors of four bits and less. However, Digital's designers didn't feel that this elaborate architecture was necessary for computers in the network superserver class. Digital's new

ECC-Equipped Pentium Servers

Servers with Pentium or other 64-bit processors provide the most economical implementation of ECC. This table lists the Pentium-based servers available with 64-bit data paths and ECC. Competing computers equipped with Alpha, PowerPC, and Sparc processors will enter the market this year.

Company	Product	Telephone
Acer America Corp.	AcerFrame 3000MP	800-531-0616 408-432-6200
AST Research Inc.	AST Manhattan SMP Pentium	800-876-4278, 714-727-4141
Compaq Computer Corp.	Compaq ProLiant 2000/4000	800-345-1518, 713-374-0670
Hewlett-Packard Corp.	HP NetServer 5/50 LM	800-752-0900, 415-857-1501
IBM Personal Computer Co.	IBM PS/2 Model 95/195/295	800-772-2227
Tricord Systems Inc.	Tricord PowerFrame ES5000	800-729-5055, 612-557-9005

Alpha RISC microprocessor, that contains its own ECC generator, settles for one-bit error correction and two-bit error detection.

SIZE OF THE WORD

Because of the way the polynomials work, ECC is more efficient when it is computed across a longer block of data. This means that ECC can work differently at different points in the system and that there is a bottom limit for its practical application.

While you can find ECC features in data storage devices from the processor cache all the way to the tape backup facility, not all ECC systems are the same. As the storage location moves farther away from the processor, engineering economy dictates using larger blocks of data and bigger samples for ECC coding. In tape storage systems, for example, data is often manipulated in nothing smaller than 2K-byte blocks, and ECC is computed across the entire block.

The ECC checksum typically used on 2KB data words is barely a 3 percent overhead. As you get closer to the processor, the active blocks of data get smaller and the overhead necessary for doing ECC climbs.

High-end tape systems from Digital Equipment Corp., IBM, Legacy Storage Systems, Sytron Corp., and Transitional Technology offer products using ECC coding computed across large data words.

Moving closer to the processor, Distributed Processing Technology (DPT) manufactures ECC-equipped SCSI controllers designed especially for RAID drives. The highest level DPT SCSI controller uses a powerful Motorola 68020 processor to control the flow of data and to manage the ECC process.

Inserting ECC at the level of a disk controller has several advantages. First, the SCSI cable might leave the computer's cabinet to attach to a stack of external drives. ECC protects the integrity of the data regardless of what electrical spikes the cable might pick up because the ECC number is stored with the data on the disk. Second, the processor on

the adapter only moves data in 512-byte blocks, so in effect the minimum data word is 512 bytes. The ECC checksum for a 512-byte block is 16 bytes wide or just over 3 percent of the data word, so the storage overhead is low.

In contrast, a byte-level ECC number designed to correct one-bit errors and to detect two-bit errors contains five bits: That's an unwieldy 38 percent of the data word devoted to ECC.

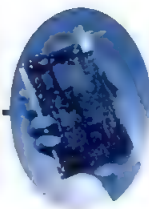
In general, the break-even point is a 64-bit level. If you are dealing with a 486-based system using 32 bit-wide memory addressing, ECC still probably costs more than it is worth because it requires special memory designs. Typically, a 32-bit data path becomes 39 bits wide when you add ECC. Since SIMMs come in four-bit slices, you'll effectively use 40 bits per 32-bit word, driving up the cost of the system and memory.

In a computer using a processor with a 64 bit-wide data path, the more efficient ECC formula ultimately results in the same amount of memory overhead as parity: one bit per byte. You literally get ECC for the price of a small processor, typically an application-specific integrated circuit (ASIC) that computes the new ECC number, compares it to the stored num-



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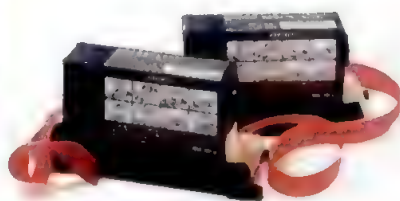


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nomical than any disposable cartridge solution — even if you recycle — because there are no cartridges or cartridge parts to waste. For a free calculator wheel to figure your likely savings, or to reach the nearest Kyocera representative, call **1-800-2-ECOSYS**.



CIRCLE 869 ON READER SERVICE CARD

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†Comparisons based on InfoCorp standards of 5% average page coverage and 16,500 pages per month "high-volume" printing, cartridge list prices as of 8/93, yields from manufacturer information.

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ber, and acts appropriately if a 1 bit appears in the result. This is a pretty simple chip, and the experts we talked to agree that its activities do not appreciably slow the throughput of the system unless it finds an error.

Interestingly, 64-bit processors are becoming more common. Processors with 64-bit capabilities include Intel's Pentium, Digital's Alpha RISC, the NEC/Silicon Graphics R4200, the Sun Microsystems Computer Corp. SPARC V9, and the upcoming IBM/Motorola 620 (part of the PowerPC family). All of these processors either have or are designed for users of Microsoft Windows NT, Unix, or some version of NetWare, so they compete for the interest of almost all network managers who might need ECC protection for their data.

ECC MANAGEMENT

A function that only corrects one bit every three months certainly isn't on the top of your list of network management indicators to watch, but if the error-fre-

quency rate rises above that, you'd probably like to know about it. Although the architectures differ, computer systems typically provide a way for the ECC processor to record its one-bit error detection and correction actions in a hardware register. Various companies provide utilities you can use to read the register, but Digital, Compaq, and IBM have done the most with ECC management. Probably because ECC reporting implementation is so unique to specific types of hardware, it hasn't yet made it as an SNMP specification.

Digital's extensive use of ECC memory in its high-end systems carries into the VMS operating system. VMS can use ECC reports to segment a section of memory with repeated errors and make it unavailable. That's a trick that OS/2, Windows NT, and NetWare haven't learned yet. In lower-end systems, people using different Digital computers and operating systems can see ECC information using the Digital Polycenter management software.

Compaq's Systempro/XL and ProLiant computers use internal error logs in nonvolatile RAM that are monitored by Compaq's Server Manager hardware or its Insight Manager software. The network administrator can set the management system to generate alerts at any level of error-correction reports.

IBM's new NetFinity for OS/2 is an extensive network program that can monitor and report single-bit ECC memory corrections from high-end IBM computers. A simple screen display allows you to specify the level of corrections that will generate an alert.

ECC FOR ALL

Price-conscious shoppers will never get ECC technology. But value-conscious buyers, particularly those evaluating systems with high-end processors in the Pentium, Alpha, and PowerPC class, should keep ECC high on their checklists. Choosing to use ECC up front could avoid a costly processor halt sometime in the years to come. □

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Network Archivist 2.0

Cheyenne
ARCserve

Maynard
Maynstream

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Librarian

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FIRST LOOKS

HANDS-ON EVALUATIONS OF THE NEWEST NETWORK PRODUCTS

► P R E - V . F A S T M O D E M S

Dual Paths to Achieving Scorching Speed

BY STEVEN SATCHELL

It seems only yesterday we thought 19.2 Kbps (V.32bis) was going to be the top modem speed. Now with the pending 28.8-Kbps V.fast Class standard (V.fast) on the verge of being ratified, the floodgates are opening in front of the fastest modems yet.

■ Inside V.fast

So what exactly does V.fast give you? V.fast modems will test the telephone line and establish a connection that is as fast as the line can handle. The signal converter (data pump) can make adjustments to yield the maximum possible data rate.

The telephone network is now largely digital, so the modems are able to gain an extra boost by adjusting their output level slightly and finding the sweet spot in analog-to-digital converters, which are part of the telephone circuit.

Another obvious adjustment is the modem-to-modem data rate. There are 12 rates in all, ranging from 2,400 bps to 28.8 Kbps in 2,400-bps increments. This lets the modem throttle back—known as *falling back*—to a lower speed in much smaller increments when it is faced with lots of line noise.

Equalization circuits let the modems compensate for any of a number of common defects in the telephone channel.

We review two modems: the Hayes Optima 288 and the Motorola Codex 3261FAST SDC.

The 3261FAST uses Codex's proprietary implementation, which reaches 24 Kbps, while the Optima 288 uses Rockwell's implementation, which runs at up to 28.8 Kbps. Both are backwards-compatible with older modem protocols. Only the Optima 288 offers fax support. Both companies will offer to upgrade these modems—for a fee, of course—to the new standard either through a modem swap or by installing new ROM. End users, especially, will benefit from the Hayes Optima 288, and network managers will benefit

from the Motorola Codex 3261FAST SDC.

Both products will be especially useful for connecting remote offices. Indeed, this might be their biggest market. These modems are not for information service users: Many of the services are just now offering 14.4 Kbps. But telecommuters will appreciate the speed increase from V.32bis modems. While ISDN is even faster, V.fast modems have the advantage of working everywhere because they don't need special services and equipment.

The performance of both of these products over real phones was about the same.

Continues on page NE18

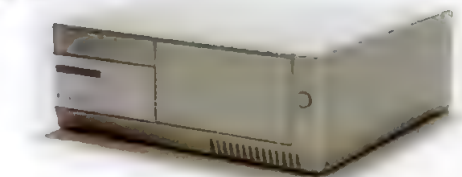
► R E M O T E N O D E , R E M O T E C O N T R O L

LANexpress Stands Out from the Remote-Access Crowd

BY STEVE RIGNEY

Trying to figure out which remote-access server to buy can be rather intimidating. The choices are seemingly endless, and you are often faced with limited features and hidden costs. The Microcom LANexpress, Version 1.0, may be the answer you've been looking for: It is a complete hardware and software solution that provides every feature you could want in a remote-access server for a price that is more reasonable than it first appears to be.

The LANexpress remote-access server supports both remote-control and remote-node access, as well as dial-in and dial-out access. Additionally, LANexpress is easy

**DOUBLE FEATURE:**

Microcom's LANexpress provides both remote-control and remote-node network access.

to set up, compliant with the Simple Network Management Protocol (SNMP), supports both Microsoft Windows and DOS clients, and utilizes high-speed 28.8-kilobits-per-second (Kbps) modems in order to deliver strong performance.

One of the best features of the

Continues on page NE22

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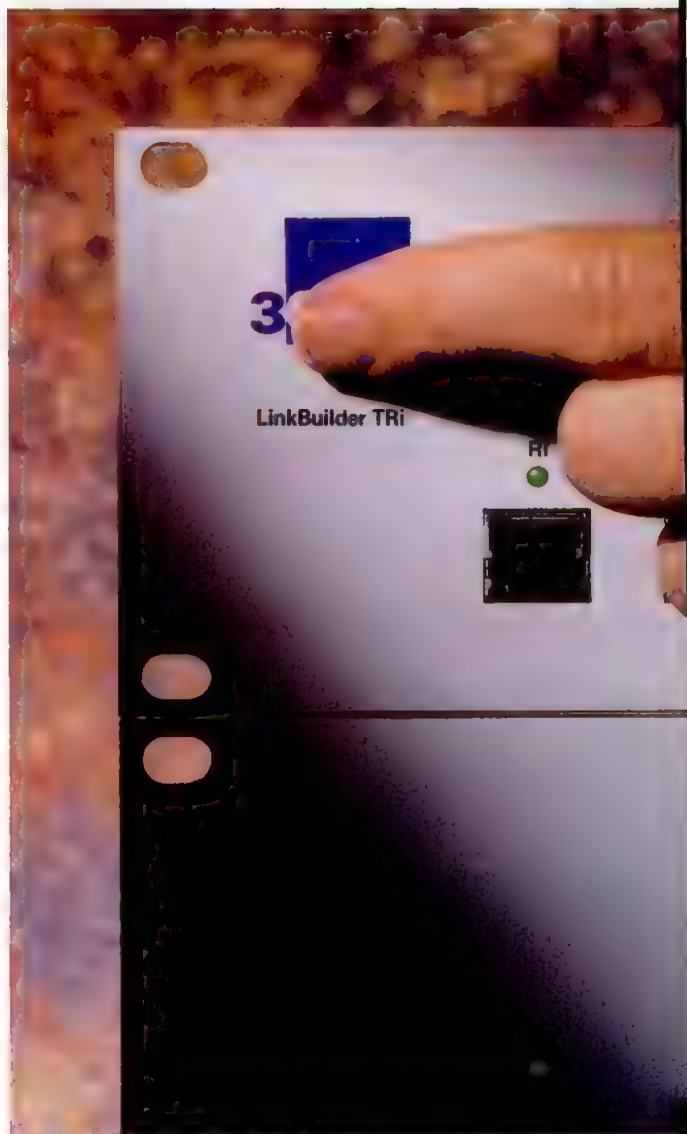
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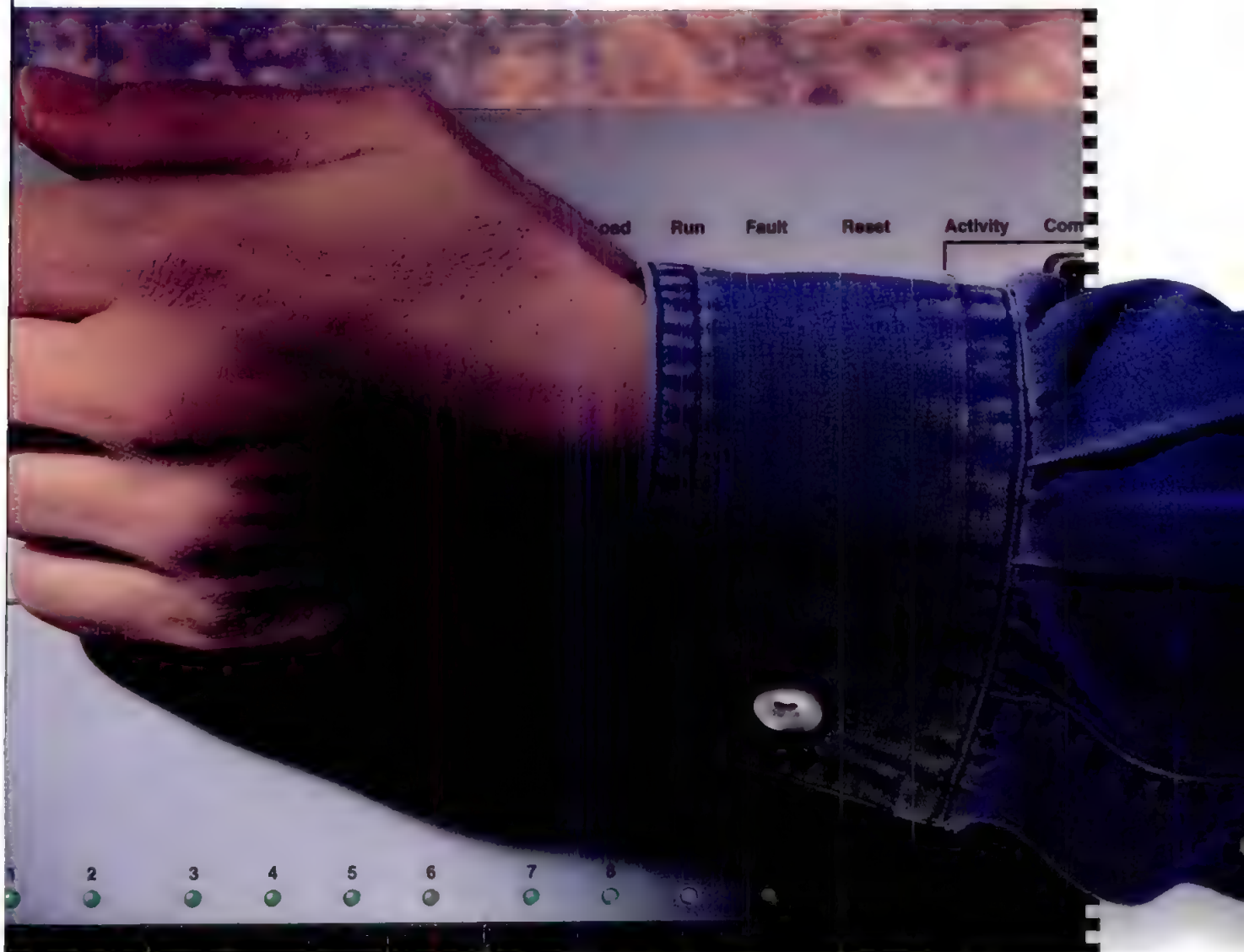


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CIRCLE 874 ON READER SERVICE CARD

Pre-V.fast modems

CONTINUED FROM NE15

The theoretical 4-Kbps difference will be seen only under rare optimal communications conditions. The modem-to-PC interface will tend to be more of the bottleneck than the modem speed itself. In a test where we added enough noise and distortion to cause a Practical Peripherals PM14400FXSA modem, one of the better performers in our June 29, 1993 modem comparison, to connect at 12 Kbps, both the Codex and the Hayes were able to connect at 16.8 Kbps.

HAYES OPTIMA 288

For many, Hayes still represents security and reliability in modems. They will be happy with the new Optima 288. Hayes's latest modem couples Rockwell's V.fast chip with fax capability (14.4-Kbps Group 3). It costs about \$700 less than the 3261FAST and supports Class 1 fax programs. Upgrade to the V.34 standard will come for \$100 through either a ROM change or a replacement modem.

Like all Hayes external products, the Optima 288 comes with eight LEDs. SmartCom for Windows LE and Windows Fax are also bundled with the package, though no PC cable is included. This product is much more well-suited for the end user, primarily because of its fax capability and price.

Our only concern is the way it connects to the PC. Communication programs in general and Windows communication programs in particular will have a difficult time keeping up with the Optima's 230.4-Kbps serial port speed. The Microcom DeskPorte Fast, one of the first V.fast modems, got around this problem by sacrificing compatibility with many DOS communications packages and writing to the parallel port. Hayes tried to avoid this problem by using a slightly modified serial port to enable the modem's port to talk to the Hayes ESP-II boards at serial-port rates up to 230.4 Kbps.

Hayes demonstrated this capability using Smartcom II. Other communications programs have to be content to run at a top speed of 115.2 Kbps. Unless they have

been modified to work with the ESP II or other super-speed serial card, you won't get the full modem-to-PC performance. Pushing the serial port up to 230.4 Kbps, however, is pushing it far beyond its specified 64-Kbps maximum speed.

Another performance twist: The Optima 288 has the largest V.42bis dictionary we've seen in any modem, allowing for better compression. The dictionary is where the modem looks for previous occurrences of the data being sent. If it finds the data, it sends a brief pointer to a location in the dictionary. In e-mail applications, the modem may no longer be the bottleneck because of the compression ratios obtained transferring text coupled with the super-fast transmission speed.

If you're looking for a high-speed connection to a PC at home or at the office, this is the modem to buy. It's less expensive

notable drawbacks, but these features shouldn't deter the network manager bent on acquiring the right modem for the modem pool.

Despite its theoretical maximum speed, which is 4 Kbps lower than the Optima 288's, the 3261FAST's performance is particularly suited for centralized banks of modems—or modem pools—for three reasons. First, it incorporates compression of synchronous data, a feature that can double network throughput when used with synchronous routers for linking two LANs. Second, it improves PC-to-modem performance, a real bottleneck, by connecting to PCs not only through RS-232 but also through the more expensive V.35 high-speed interface and the EIA-530 serial interface—an emerging serial-port specification. Our tests showed that the 3261FAST achieves 24 Kbps on any line on which a V.32bis modem can achieve its top-rated speed.

Manageability is another area that differentiates modems designed for use with bridges and routers or as part of industrial-strength communications servers. Central management is the key here. From a single control station you can get a variety of modem statistics fed through a separate external connection. Similarly, you can get detailed line statistics by looking at the LCD/LED panel.

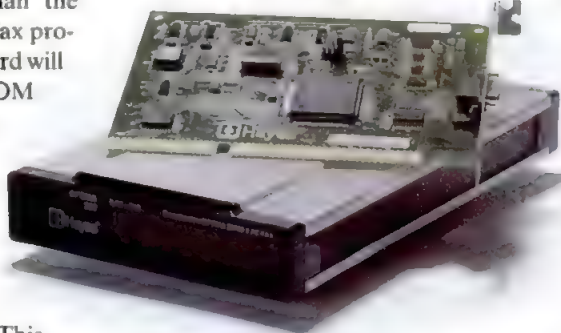
The modem is also reliable: It can reset itself when a problem occurs. Consumer-grade modems such as the Optima 288 do not offer this kind of intelligence.

On the downside, the protocol employed by the 3261FAST is not used by other modems. Because of this, the modem will typically be used for communications within companies, which is exactly what bridges, routers, and to some extent servers need. The modem's documentation is thorough but quite cumbersome. Finally, its price is quite high.

While a V.fast upgrade is available for no charge when moving to 24 Kbps, it will run you half of the list price of the initial purchase when moving to 28.8: about \$650.

• List price: *Motorola 3261FAST SDC (external)*, \$1,295. *Motorola Codex*, 20 Cabot Blvd., Mansfield, MA 02048; 800-446-6336, 508-261-4000.

Circle 961 on reader service card



GARBO AND MONROE: The Codex and the Hayes (above) are aimed at different markets.

than the Codex and offers software, which the Codex modem does not. There are concerns, most pointedly its serial interface, but for many the Hayes name will more than compensate for these worries.

• List price: *Hayes Optima 288*, \$579; *Hayes Microcomputer Products Inc.*, P.O. Box 105203, Atlanta, GA 30348-5203; 404-441-1617; fax, 404-449-0087.

Circle 960 on reader service card

CODEX 3261FAST SDC

Industrial strength is about the best description of the Codex 3261FAST SDC. Three things suggest that this \$1,295 modem is aimed squarely at IS shops: its performance, management, and durability. A proprietary protocol, poor documentation, and a high price tag are the most

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Microcom

CONTINUED FROM NE15

LANexpress is the ease with which you can install it. Just take it out of the box; plug in the power, network, and telephone lines; and turn on the machine. All of the software and modems are preconfigured. The LANexpress is about the same size as a desktop PC and includes a 486 CPU and either two, four, or eight 28.8-Kbps modems. Other turnkey solutions such as the Shiva LANRover are also easy to install, but still require you to install and configure your modems.

The LANexpress server allows you to dial into your network via remote node or remote control—or both at the same time. You can use the remote-node connection to compose and send e-mail while you use remote control to work in a database on the network. Other remote-access products such as Digital Communications Associates's Remote LAN Node (RLN), Stampede's Remote Office, and the LANRover only offer remote-node access. The U.S. Robotics CommServer 386 offers a turnkey solution for both remote control and remote node but can only support one port.

The LANexpress Remote utility establishes your remote-node and remote-control connections. LANexpress is also bundled with a network version of Carbon Copy, Microcom's remote-control application.

You can use the LANexpress server with any DOS or Microsoft Windows communication software compliant with the Novell Asynchronous System Interface (NASI) to dial out from your PC using a network modem. NASI is Novell's standard for redirecting outgoing data from your serial port to the network adapter, granting you access to shared network modems.

The LANexpress acts as both a network bridge and a router, providing two distinct benefits. First, its multiprotocol bridging capabilities allow you to communicate using different protocols. Second, the routing reduces packet size by eliminating the need for extensive addressing information, thereby increasing performance and reducing connect time.

The LANRover utilizes routing, and the

Remote-Access Servers

Products listed in alphabetical order	DCA Remote LAN Node	Microcom LANexpress	Novell NetWare Connect	Shiva LANRover	Stampede Remote Office	U.S. Robotics CommServer 386
■ = YES □ = NO						
List price	\$3,795 (8 nodes)	\$7,999 (8 nodes)	\$3,795 (8 nodes)	\$3,499 (8 nodes)	\$2,195 (8 nodes)	\$1,995 (1 node)
Configuration	PC-based	Standalone	PC-based	Standalone	PC-based	Standalone
Ethernet and Token-Ring support	■	■	■	■	■	■
Full multiprotocol bridge/router	□	■	□	□	□	□
Dial-in/dial-out support	■ □	■ ■	■ ■	■ ■	■ □	■ ■
SNMP management	■	■	□	■	■	□
Remote management	□	■	□	□	■	■
Support for V.fast modems	□	■	□	□	■	■
Maximum WAN port speed	57.6 Kbps	400 Kbps+	57.6 Kbps	57.6 Kbps	115.2 Kbps	57.6 Kbps
Parallel-port modem support	□	■	□	□	□	□
Simultaneous remote node/remote control	■ □	■ ■	■ □	■ □	■ □	■ ■
Maximum number of nodes	16	8	32	8	32	1

RLN uses bridging, but neither does both. However, you can access the LANexpress using any network protocol as a remote node though you are limited to IPX when using a remote-control connection.

Whether you're using remote control or remote node, the LANexpress is fast, primarily because its modems communicate directly with its bus. Typically, modems communicate with the bus through a Universal Asynchronous Receiver/Transceiver chip, which controls the flow of data between a PC's serial port and the modem and hinders throughput.

Dialing in with a 28.8-Kbps modem, you can theoretically achieve a maximum data-transfer rate of 115.2 Kbps using V.42bis compression. For our tests, we used Microcom's DeskPorte FAST serial and parallel modems to access the LANexpress server at 28.8 Kbps. Because of real-world factors, including line noise and cable quality, our throughput hovered around 70 Kbps—not quite up to the theoretical plateau, but impressive nonetheless.

The LANexpress is fully manageable via SNMP and supports both MIB I and II, along with a few proprietary MIBs. Microcom's expressWatch management utility allows you to monitor and configure the LANexpress from any Windows-based PC on the network. expressWatch allows you to keep an eye on the remote connections as well as the server's network connection by providing packet statistics for both. Port status, errors, and other statistics can also be tracked with expressWatch.

LANexpress is available in several

configurations for both Token-Ring and Ethernet. An eight-port Ethernet unit with all the hardware needed for the server and a single-client software license will cost you \$7,999. Each additional remote-client license sells for \$50.

As a rule, it is difficult to compare the prices of remote-access products because the configurations of such products are greatly varied: In an eight-port configuration, DCA's RLN and Novell's NetWare Connect are cheaper (\$3,795), but they are not complete hardware/software solutions—you still need a PC and modems for each. It is not unusual for the total price of an eight-port remote-access server—including all the hardware and the time spent putting everything together—to meet or exceed \$10,000.

While it may seem expensive at first glance, the Microcom LANexpress could actually save you money in the long run by giving you everything you need in a remote-access server for one lump sum. LANexpress is the most versatile remote-access server we have seen to date, and it is a perfect solution for organizations that have to tailor their communications setup in order to meet the needs of users who use different kinds of remote access.

• List price: *Microcom LANexpress*: Ethernet: \$3,499 (2 modems), \$4,999 (4 modems), \$7,999 (8 modems); Token-Ring: \$4,399 (2 modems); \$5,899 (4 modems), \$8,999 (8 modems). *Microcom Inc.*, 500 River Ridge Dr., Norwood, MA 02062-5028; 617-551-1000; fax, 617-551-1007.

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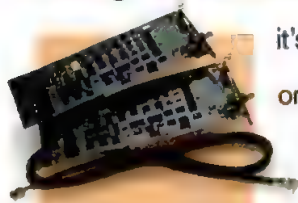
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► REMOTE-SITE NETWORKING

A Router That Anyone Can Install

BY MICHAEL BLAKELEY

The prospect of setting up a router in a remote office can strike terror in the heart of the staunchest network administrator. That need no longer be the case, thanks to HP's latest low-end router, the Router PR. The Router PR offers everything that is important to remote-office connectivity: plug-and-play setup, solid internet-working features including a new compression technique, interoperability with the market-leading Wellfleet routers, and a low price.

HP designed the Router PR with one purpose in mind: to link remote offices with a central site easily and affordably. At a list price of \$2,995, the Router PR is definitely affordable. It is also so easy to set up that you should not have to send technicians to install it. With its small size

and solid construction, you could even ship it to your remote office.

The Router PR competes with Cisco's 2000 and 2500, Wellfleet's Access Feeder Node, and 3Com's NETBuilder boundary routers. Of these, only the 2500 costs as little as the Router PR, and none are as easy to install. The 2500 offers more features, such as optional Token-Ring and ISDN ports, but it is considerably more complicated to set up. However, the other routers are all expandable, where the Router PR is available in a single hardware configuration: with a WAN port, an Ethernet port, and a console port.

What really sets the Router PR apart is ease of installation. There isn't even a power switch: The Router PR goes to work as soon as it is connected to AC power, an Ethernet LAN, and a WAN link. In its default software configuration,

the Router PR is unique in that it automatically senses a connection on the WAN port and comes to life as a transparent bridge between the Ethernet LAN and the WAN. No other router we know of gets you up and running so quickly.

You can adjust the software configuration from an SNMP console or connect a terminal, a PC running terminal-emulation software, or a modem (for dial-in terminal connections) to the back of the router in a few minutes. HP provides an excellent menu-based configuration-software utility with which you can assign IP and IPX addresses and activate other features such as compression, bridging, and SNMP manageability. We configured the router for the ZD Labs WAN test-bed in less than half an hour.

The Router PR supports both IP and IPX and provides transparent bridging to handle nonroutable protocols such as NetBIOS and NetBEUI. The Cisco 2500 supports these as well as DECnet and AppleTalk. The Router PR can be managed via SNMP and, like most routers,

Finally, remote office routers may be bigger than

 ■ If your head is nodding yes, yes, yes, to remote office networking, but your budget is saying no, no, no, let us show you the perfect solution. The new 3Com® NETBuilder® Remote Office family of bridges and routers.

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The new NETBuilder Remote Office bridges and routers are the perfect foundation for a growing network: They are low-cost, yet packed with features others offer only as costly options: Dual Image Flash PROM, an integrated 10BASE-T transceiver, auto start-up, a back-up WAN port, rack mount kits, and a full set of LEDs for remote troubleshooting and remote configuration capabilities. There's no simpler and cost-effective way to make a LAN and WAN connection, and still have the security of buying from a major vendor.



supports the MIB II subgroups. Unlike most routers, the Router PR supplies an interface compatible not only with HP OpenView for Unix or SunOS (which HP recommends), but also with Wellfleet's Site Manager, Version 5.x. The current release of HP OpenView for Windows does not support router management, so you still need an expensive management package to manage this inexpensive router properly.

Perhaps the most highly touted feature of the Router PR is its new compression algorithm. Unlike routers that perform compression only on the headers of TCP packets, the Router PR can compress entire packets moving across the WAN link. This compression operates only over WAN links running Wellfleet's proprietary point-to-point protocol, its serial-link protocol for inter-WAN communications (not the same as the Point-to-Point Protocol). However, our testing indicates that most Novell-only or mixed-protocol sites may want to turn off the compression in order to avoid

the performance degradation associated with compressing IPX packets.

According to file-transfer tests conducted by ZD Labs, the Router PR delivers good throughput using both the IP and the IPX protocols without compression. With compression, however, IPX's packet size, which is smaller than that of IP,



SIMPLE BUT EFFECTIVE: The easy-to-install Router PR is perfect for remote sites.

causes problems for the compression engine because there is less redundant data—which is what compression techniques try to eliminate—in each packet. Since there isn't much to compress, and the router still spends time trying to com-

press each IPX packet, the aggregate throughput drops by about 10 percent. On the plus side, IP performance improves by 5 percent with compression.

Nevertheless, the HP's performance was nothing to sneeze at. It ran neck and neck with the Cisco 2500, another brand-new offering in the remote-access market.

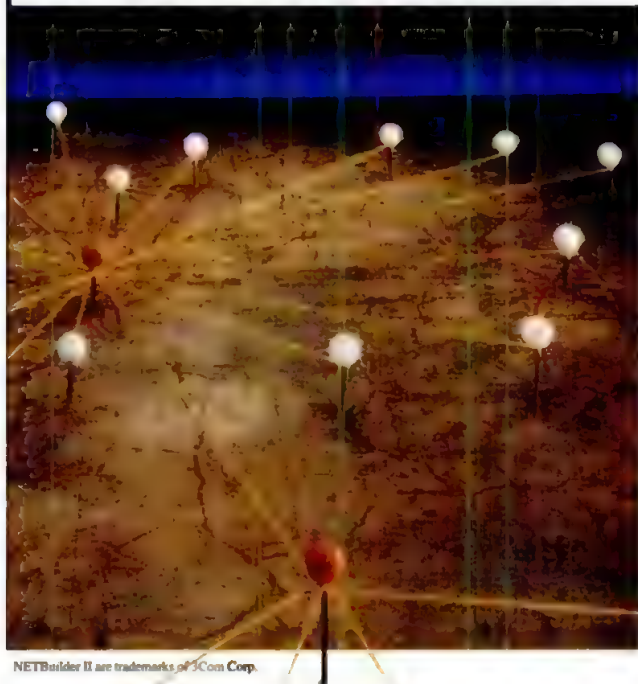
When all routers are this simple to set up, you'll be able to forget other concerns and just look for the best price. For now, though, Hewlett-Packard has done an excellent job of building an affordable router that's easy to live with.

The features are solid, and the performance is good. We recommend you take the time to turn off the compression, but performance for remote sites is often less important than the cost—in both dollars and man power—of installation.

• List price: *HP Router PR*, \$2,995. Hewlett-Packard Co., 8000 Foothills Blvd., Roseville, CA 95747-6588; 916-786-8000.

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► HUB - IN - A - PC

A Hub for True-Blue Remote Sites

BY O. RYAN TABIBIAN

Your remote-site clients may be running NetWare, but you've got an IBM mainframe in the central office. You need a simple, effective, and affordable way to get them connected without overloading on hardware. The LanOptics 3001 BranchNet hub may solve your problems: It combines a PC and a hub in the same box and throws in unparalleled connectivity with mainframe and midrange systems for good measure.

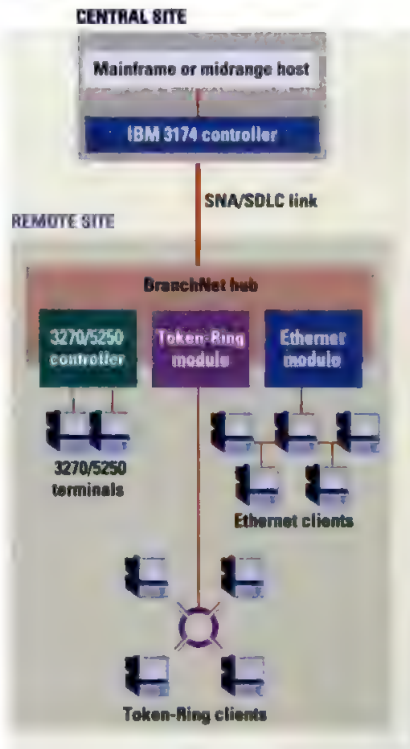
The BranchNet hub is an excellent choice for linking remote offices to central networks organized around the System Network Architecture (SNA), IBM's standard architecture for mainframe-centric networks, rather than around NetWare. In addition to supporting Ethernet and Token-Ring clients, the BranchNet can also support both 3270 and 5250 terminal emulation, with which you can connect to IBM mainframes and AS/400s, respectively—not to mention the fact that it can act as a high-end server.

This strong host support differentiates the BranchNet from other PC/hub combinations. Cabletron and NetWorth also offer PC/hub solutions, but they are intended for the NetWare environment rather than the integrated PC/host environment. Cabletron's PCMIM is a NetWare server-expansion module that can be used with the MMAC hub family, the company's line of stackable hubs. NetWorth's offering, the NetWare Application Engine, is also a NetWare server on a module that can be plugged into any of NetWorth's hubs, including the three-slot Department Command Center, designed for the remote-office market.

Unlike the Cabletron and NetWorth solutions, the BranchNet is actually a PC modified to act like a hub (rather than a hub modified to act like a PC). It includes a 486 CPU, 6MB of RAM, a 65MB hard disk, and four ISA expansion slots along with three smaller-than-average hub slots. Each hub module can support as many as 12 ports.

We configured the BranchNet hub with a Token-Ring card to connect four clients and an SNA/synchronous data link control (SDLC) card through which we connected to a 3174 controller. (SDLC is the protocol used to connect terminals and

ALL-IN-ONE: The BranchNet lets you consolidate your connectivity needs in a single box by supporting links to IBM hosts as well as to Token-Ring and Ethernet clients.



mainframes in SNA environments. The 3174 serves as an interface between PC environments and IBM mainframes.) We found the BranchNet very easy to install and configure, a fact that should appeal to network administrators.

The BranchNet is configured with an SNMP agent that you can monitor using either StarView, LanOptics' Windows-based network management application, or NetVIEW, IBM's host-based management console. You will also be able to manage the BranchNet through an application slated for release later this year for NetVIEW/6000, IBM's Unix-based

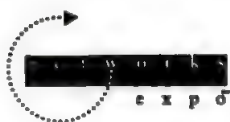
SNMP platform.

The BranchNet can be configured as a bridge, a gateway, or a router. As a bridge, it can connect to other BranchNets either locally via a null modem cable or remotely over leased-line Switched 56 or T1 WAN links. As a gateway, it can interface with controllers such as the 3174 using an SNA/SDLC link. With the SNA/SDLC link, there is no need to connect to the 3174 controllers via an external bridge, which is normally required. The third configuration allows you to set the BranchNet up with an IBM RouteXpander/2 ISA router card, which supports IP, IPX, and VINES/IP, among other protocols. This configuration allows you to connect to a WAN using leased lines. LanOptics plans to expand the BranchNet's routing capabilities by offering a Cisco 3000 router card for the hub.

And since it is a PC, the hub can also act as a high-end server: All you have to do is install a network operating system. Combining multiple functions in this way is in some ways appealing, especially to remote-office sites where cost and space may be prime considerations. There is, however, a risk associated with putting too many things in a single box: If any individual component in the BranchNet crashes, it is quite likely that your network—or at least the remote segment—will crash as well. There are no provisions in the BranchNet for redundant power supplies, error correction code memory, or other fault tolerance features that are typically seen in servers.

If your remote-office network needs connectivity to IBM hosts, the LanOptics 3001 BranchNet is an excellent solution, especially if you need to keep the hardware overhead down at your remote site. On the other hand, if your remote site needs to connect to a NetWare LAN, you may find the remote-office solutions from Cabletron or NetWorth more suitable.

• List price: *LanOptics 3001 BranchNet*, \$10,900; *Ethernet module*, \$1,400; *Token-Ring module*, \$1,700; *3270 terminal-emulation module*, \$900; *5250 terminal-emulation module*, \$750. *LanOptics Corp.*, 13748 Neutron Rd., Dallas, TX 75244; 214-392-0647; fax, 214-385-0723. Circle 963 on reader service card



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NEW

Cisco Gets Remote Users Connected...

Cisco's new remote-access routers offer network managers more for less—more ports and more software platforms for less expense than the Cisco 2000 series. The 2500 Series routers feature an additional synchronous serial port, a native ISDN connection, and a choice of several router software packages. Having a native ISDN basic-rate interface obviates the need to purchase expensive external ISDN terminal adapters. The new router software platforms allow users to choose from three feature sets. The first suite, IP Router Software, includes support for dial-on-demand routing; frame relay; High-level Data Link Control; IP; PPP; transparent and source-route bridging; X.25; and the Border Gateway Protocol (BGP), Exterior Gateway Protocol (EGP), Interior Gateway Routing Protocol, open shortest path first (OSPF), and Routing Information protocols. The second suite, Desktop Router Software, addresses the needs of network managers who implement only a few protocols; it includes all IP router software features as well as support for IPX, AppleTalk, and DECnet Phase IV. The third choice, Enterprise Router Software, includes all Cisco-supported communication protocols, routing protocols, WAN technologies, and protocol translation software that provides a gateway between X.25, TELNET, and Digital Equipment LAT environments.

• List price: Cisco 2500 Series: Model 2501, \$995; Model 2502, \$1,495; Model 2503, \$1,695; Model 2504, \$2,195. Cisco Systems Inc., P.O. Box 3075, 1525 O'Brien Dr., Menlo Park, CA 94026; 800-326-1941, 415-326-1941; fax, 415-326-1989.

Circle 951 on reader service card

NEW

...and 3Com Aims To Make It Simple

Making a good thing even better seems to be the trend. 3Com aims to make remote-office networking easier and more cost-effective than solutions offered by its competitors. Like Cisco, 3Com expands on an already popular family of

routers—the NETBuilder line—with a new remote-access router: the NETBuilder Remote Office 201, priced under \$2,000. Offering both LAN and WAN connectivity, the NETBuilder 201 incorporates both Ethernet and Token-Ring technologies and offers a wide selection of WAN services including frame relay, ISDN, PPP, Switched 56 (SW-56), and X.25. The new router can be used in conjunction with 3Com's network management application, Transcend, allowing Transcend to view the remote site as a single logical entity. It also features disaster recovery, bandwidth-on-demand, dial-on-demand, and troubleshooting capabilities for ease of management.

• List price: 3Com NETBuilder Remote Office 201, \$1,995. 3Com Corp., 5400 Bayfront Plaza, P.O. Box 58145, Santa Clara, CA 95052-8145; 800-638-3266, 408-764-5000.

Circle 952 on reader service card



GOOD CONNEC-
TIONS: NETBuilder 201 incorpo-
rates LAN and WAN technologies.

HOT PROSPECT

Look, Mom! I'm on ...the Computer?



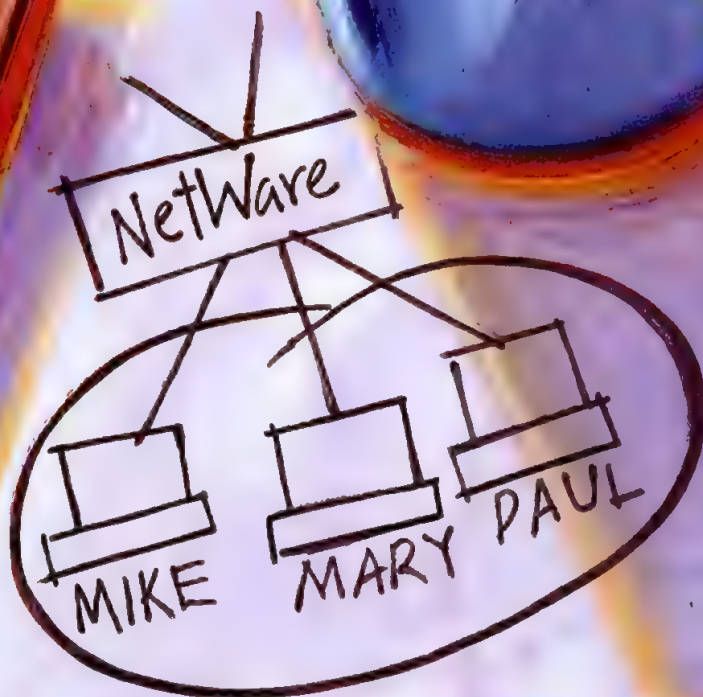
With the cost of videoconferencing dropping drastically over the last few months, Intel Corp. enters the arena, bringing an affordable solution right to your desktop. The ProShare family lets users in different locations work together while viewing each other on their PCs.

ProShare Personal Conferencing software, used with the Intel ProShare Video System 200, allows users to see each other face-to-face. Users can choose between the Standard Edition software, a white board product where two remote users can work on documents simultaneously via modem or network, and the Premier Edition, where two users can share a software application even if one of them does not have the application.

The Video System 200 includes video and communications add-in boards, a monitor-top video camera, a hands-free headset with microphone, and the ProShare Standard Edition software.

• List price: ProShare Personal Conferencing: Standard Edition, \$99; Premier Edition, \$299; Intel ProShare Video System 200, \$2,499. Intel Corp., 2200 Mission College Blvd., P.O. Box 58119, Santa Clara, CA 95052-8119; 800-538-3373.

Circle 958 on reader service card



How much work could a workgroup do if a workgroup could work grouped?

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New Personal NetWare works with what you've already got to create a computing environment that helps your workgroups work better together. If that sounds good to you, call 1-800-554-4446 for a free demo disk or, if you prefer, get the facts by fax at 1-800-NETWARE, and request document #9013. You'll be surprised at how much work workgroups can do once they're working grouped.

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IMPROVED

Cabletron Limits Delay and Cost of Switching

A bevy of hub-switching technologies are flooding the market, and Cabletron re-enters with talk of implementing a new, cost-effective switch. The Cabletron technology dubbed Fast Packet Switch (FPS), rooted in Cabletron's SecureFast Packet Switching (SFPS)—a high-bandwidth switching method found in its high-end hub line—will be seen in the Multi Media Access Center (MMAC) family of hubs; the Hubstack line of stackable hubs; and the MMAC-Plus, the company's intelligent switching hub. Like SFPS, FPS performs packet switching in Ethernet, Token-Ring, and FDDI environments. However, whereas SFPS operates in a connection-oriented environment, FPS can perform packet forwarding in either a connection-oriented mode (an established transmission session between two nodes) or in a connectionless mode (a transmission session in which packets include a source and destination address).

FPS also differs from its predecessor in that all packet switching takes place in the hardware through a series of application-specific integrated circuits (ASICs). By implementing the low-priced ASICs, Cabletron reduces the price of switching and increases the speed and efficiency of transmission.

• *Cabletron Systems Inc., 35 Industrial Way, Rochester, NH 03867-0505; 603-332-9400; fax, 603-337-2211.*

NEW

Digital Equipment Roams Into Remote Access

The mobile/wireless networking environment is not just a trend, it's here to stay. As part of its massive announcement of more than 100 products, Digital outlined a series of software and hardware products designed to provide users with enhanced mobile and wireless communication. The RoamAbout Series, as this line is called, consists of a PCMCIA adapter, a wireless-to-wired bridge, and software.



REMOTELY ACCESSIBLE: The RoamAbout Series offers mobile and wireless communication.

The RoamAbout Wireless PCMCIA Network Adapter is a Type II credit card-size adapter that provides wireless nodes with access to wired Ethernet LANs via Digital's RoamAbout Access Point, a two-port wireless-to-wired bridge. The adapter includes ODI and NDIS drivers to support LAN Manager, NetWare, NetWare Lite, and Pathworks. The RoamAbout Access Point uses spread-spectrum technology

to provide connectivity between wireless nodes and wired LANs.

The two software packages are RoamAbout Transport Communications Software and RoamAbout Mobile IP. RoamAbout Transport extends client/server applications to mobile users via cellular, dial-in, or packet radio-connecting services. RoamAbout Mobile IP allows wired and wireless devices to roam across LAN boundaries while maintaining application and service connections.

• *List price: Digital RoamAbout Wireless PCMCIA Network Adapter, \$595; RoamAbout Access Point, \$600; RoamAbout Transport Communications Software, \$199 per client, \$799 per server; RoamAbout Mobile IP, \$60 per client, \$320 per server. Digital Equipment Corp., 550 King St., Littleton, MA 01460; 508-486-5198.*

Circle 954 on reader service card

BRIEFS

NETWORK MANAGEMENT

Ungermann-Bass announced NetAssistant (\$795), a Windows-based, entry-level network management application engineered for managing Ungermann-Bass hubs. NetAssistant is designed primarily for the company's stackable environment (Access/Stax hubs) and provides four basic management functions: device discovery and mapping, device configuration, logging of network events, and solution of network problems. NetAdvice, the cornerstone of NetAssistant, provides an easy-to-understand introduction to the basics of networking and interpreting network events. It also provides explanations about the meaning and probable causes of network problems as well as possible solutions. 800-777-4526.

ADAPTERS

Kingston Technology Corp. has reduced the prices across its complete line of EtherX Ethernet network interface cards. The EtherX ISA line is down 25 percent: The 10BaseT card is now selling for \$59, the 10Base2 card is selling for \$79, and the dual-interface card that supports both is selling for \$89. The EtherX EISA line consists of a dual-interface Ethernet adapter (\$195) that supports both 10Base5 and 10BaseT and a 3-in-1 adapter (\$225) that supports 10Base5, 10BaseT, and 10Base2. 714-435-2600.

Solectek Corp. introduced a new adapter into its line of wireless Ethernet products. The AirLAN/PCMCIA (\$699) is a Type II, Release 2.0, adapter that uses spread-spectrum 915-MHz radio technology. Its antenna provides coverage of up to 800 feet. The adapter operates at 2 megabits per second and includes support for NetWare, LANtastic, and Microsoft Windows for Workgroups. 619-450-1220; fax, 619-457-2681.

THE EXPANDABLE, RELIABLE, ECONOMICAL, FAULT-TOLERANT DISK ARRAYS

RAIDION LT and LS Series disk array subsystems are designed for use with either Novell NetWare 3.1x/4.x or IBM OS/2.

MIRROR RAIDION can be configured with 2 modules to provide mirrored fault tolerance up to 3 GB.

RAID 5 Adding one module to a mirrored subsystem and installing RAIDWARE™, doubles the user capacity by converting the mirrored array to RAID 5. Under OS/2, the maximum configuration is 28 modules. Under NetWare, RAIDION can be expanded to 32 modules per array with a capacity of 93 GB.

Exceptional Warranty Micropolis offers a full five year parts and labor warranty on its entire line of high-capacity disk drives. Other RAIDION subsystem components have a one year warranty.



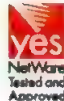
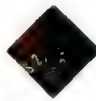
RAIDION LT can be stacked up to seven modules high for convenient desk top use.



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Award Winning In a benchmark comparison of arrays, Corporate Computing said: "Raidion was our overall winner with an impressive combination of high performance, low cost, and unparalleled expandability." May 1993. RAIDION was also named LAN Magazine's Disk Array Product of the Year for 1994.

Economical An LT Series three module 2 GB array is only \$6,585. An LS Series Raid 5 array with a capacity of 6 GB lists for \$12,825. That's just \$2.12 per MB. It's no wonder Byte Magazine said: "RAIDION's low price alone makes it worth considering." August 1992



MODULE #	CAPACITY	DRIVE FORM
LM 1050	1,050 MB	LT 3.5-inch
LM 1760	1,760 MB	LT 3.5-inch
RM 2100	2,100 MB	LS 5.25-inch
RM 3020	3,020 MB	LS 5.25-inch

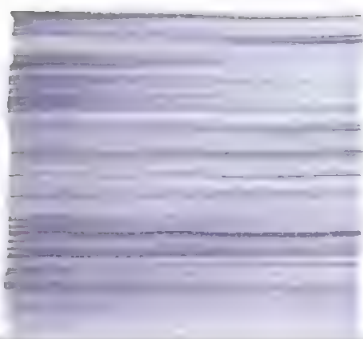
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There's nothing terribly exciting about stacks of paper. Except that Hewlett-Packard's paper-handling solutions for the HP LaserJet III Si, 4Si and 4Si MX printers let you spend a lot less time dealing with them. And when it comes right down to it, why *save time* with a 17-page-per-minute printer if you have to *spend more time* putting paper in and taking documents out?

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If increasing productivity sounds more exciting than refilling paper trays, talk to your HP representative or reseller. Or call 1-800-752-0900, ext. 7889 for more information.



*Installation is required by HP authorized service personnel. © Hewlett-Packard Company 1993

NEW

ACC's Amazon Makes Waves in LAN/WAN Connectivity

By implementing a flexible and scalable architecture, Advanced Computer Communications is able to offer Amazon, a high-performance bridge/router, for less than half the price of its preconfigured competitors from Cisco and Wellfleet. Designed for small to medium-size regional offices, the Amazon offers network managers flexibility in both configuration and price. It can accommodate a variety of plug-in modules for up to five LAN connections and 18 WAN connections.



MODULAR: Amazon accommodates up to 5 LAN and 18 WAN connections.

The main board features two Ethernet ports for either 10BaseT, 10Base2, or 10Base5 connections. The Amazon's high-speed backplane can accommodate three more LAN or WAN adapters (with six ports each). Amazon also includes bandwidth optimization features, which cut down on the expense of leasing WAN links.

• List price: ACC Amazon, \$7,500; interface modules, \$750 to \$4,000. Advanced Computer Communications, 10261 Bubb Rd., Cupertino, CA 95014; 408-864-0600.

Circle 955 on reader service card

NEW & IMPROVED

Don't Say "Moo" to This CAU

While some companies strive to be all things to all people, Madge sticks to what it knows best—Token-Ring. The company's new intelligent, stackable hub, SmartCAU Plus, offers improvements on its predecessor (SmartCAU), namely in the areas of management and monitoring. Best of all, the SmartCAU offers all the functions and management of the IBM intelligent Token-Ring hub, the Controlled Access Unit (CAU). SmartCAU Plus supports the connection of IBM-compatible Multi-station Access Units (MAUs), central hubs in Token-Ring LANs.

This enables network managers to preserve their investments in MAUs while using the fault tolerance features of the SmartCAU Plus and the advanced management features found in the upgraded version of Madge's software, TrueView CAU Manager, Version 2.0, which is included with the hub.

• List price: Madge SmartCAU Plus, \$2,995. Madge Networks Inc., 2310 North First St., San Jose, CA 95131-1011; 800-876-2343, 408-955-0700; fax, 408-955-0970.

Circle 956 on reader service card

NEW

Chipcom Announces Multiswitching Hub

Chipcom's new hub, the ONcore Switching System, addresses the requirements of enterprise networking—flexibility, manageability, and security. It also provides an upgrade path to high-speed networking. ONcore's high-speed backplane supports a variety of switching technologies, including module-, port-, packet-, and cell-switching as well as per-port switching. Chipcom's ATM plans for ONcore are being jointly developed with IBM. The hub, used in conjunction with Chipcom's network management package, ONdemand Network Control System, allows network managers to control and manage large networks down to the port level on the hub.

• List price: Chipcom ONcore Switching System, \$6,995. Chipcom Corp., Southborough Office Park, 118 Turnpike Rd., Southborough, MA 01772-1886; 508-460-8900.

Circle 957 on reader service card

BRIEFS

BUSINESS NEWS

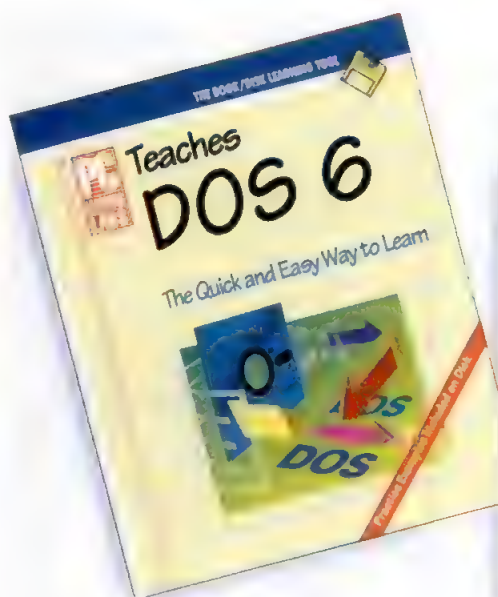
3Com Corp. is expanding the breadth of its networking line: First with the purchase of a high-speed networking company, Synernetics, and now with the purchase for \$36 million of remote-access leader Centrum Communications. Centrum provides remote-access systems for single-user connections to enterprise networks. The company will become 3Com's Personal Office division. 3Com, 408-764-5000; Centrum, 408-894-1800.

NetEdge Systems, a spin-off of Fibercom, introduced its first high-performance ATM access router. The ATM Connect (\$20,000 to \$42,500) can connect Ethernet and Token-Ring LANs as well as FDDI-to-ATM servers and workstations through ATM switches. It has four built-in Ethernet and four point-to-point WAN interfaces and features speeds up to T3. 800-638-3343.

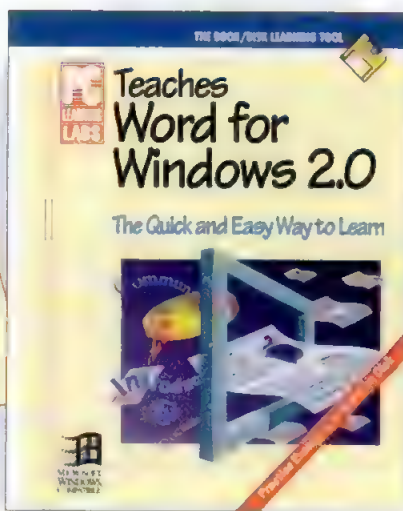
Central Point Software purchased LANlord, the workstation-management product, from Microcom and also now owns the assets of Microcom's Client-Server Technology Group. This is the second in a series of moves (the first being its merger with XTree Co.) to provide a range of network-based applications for the management and protection of data and systems. Central Point, 503-690-8080.

Chipcom Corp. and **NetLabs** signed an agreement that will allow Chipcom to develop a suite of graphical network-management applications based on the NetLabs/Vision Application Development Environment. The applications will be designed for Chipcom's bridge and switching products and will coexist with its strategic network management software package, the ONdemand Network Control System. Chipcom, 508-460-8900; NetLabs, 415-961-9500.

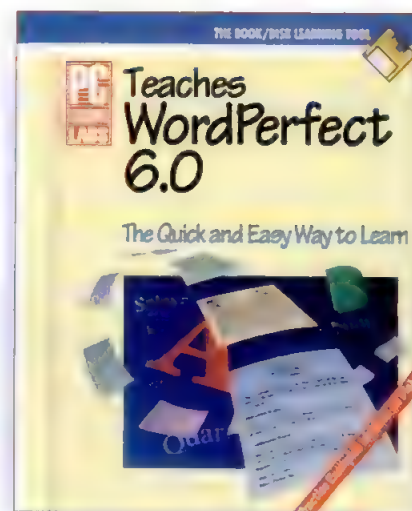
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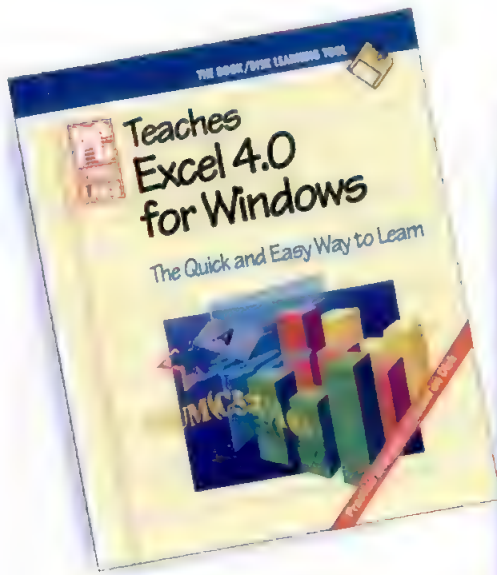
—Barry Mishkind, *Radio World*,
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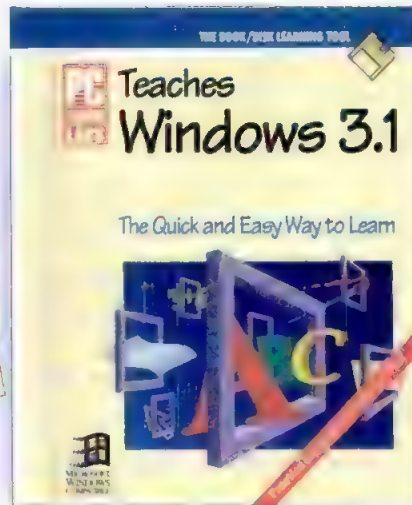
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—William J. Lynott,
Online Today, reviewing
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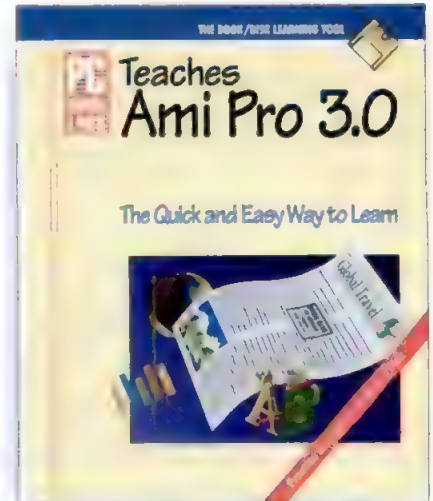
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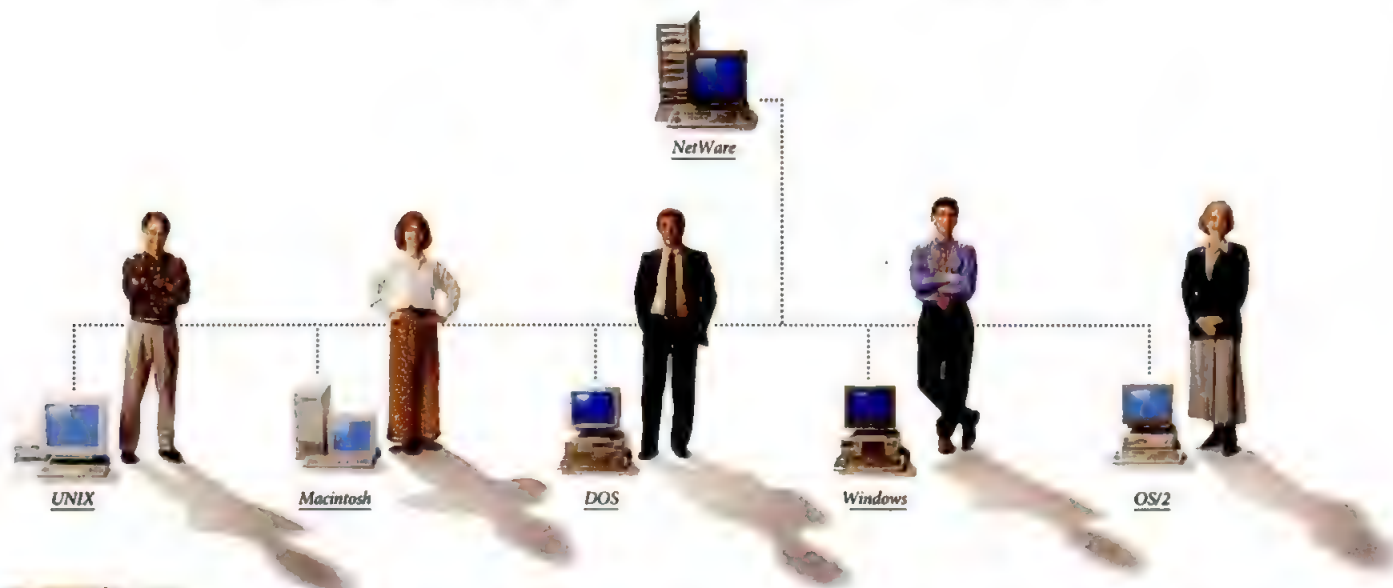
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—Hugh Anderson, *The Gazette*,
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CIRCLE 868 ON READER SERVICE CARD

Don't Get Locked In the Open

The folks from Digital, in no uncertain terms, repeatedly emphasize the company's push towards open systems. "What we do," said the spokesperson, "is geared towards standard systems. We are open."

Is this Digital? The same Digital that brought us the VAX? That helped define the word *proprietary*? When Digital talks about its open system, it's time to pay attention to change.

But I'm not sure that this battle cry for openness signifies a change for the better. Don't get me wrong: I'm as much of an advocate of open systems as anyone else, but there's open and then there's *open*. Let me explain.

There are two schools of thought concerning open systems: One teaches that open networks are based on standards. This school's faculty is out to lunch. Its lessons leave you ill-prepared to cope with the difficult tasks of running even a work-group network.

The reason is simple: Open standards are driven first by competitive pressures and only second by the needs of network managers. Open standards are nothing more than attacking the market leader. IBM, HP, and Apple are doing this to Microsoft with their Taligent effort. Proteon, Wellfleet, 3Com, and a horde of others attempted to knock Cisco's Interior Gateway Routing Protocol with their open shortest path first initiative.

And that's why you need to look at the second school, which sprinkles a bit of proprietary technology in with the open systems approach. The essence of this approach is that you have choices: You can select and connect both computer systems and network components independently. But remember: The APIs and hardware interfaces may be open, but behind them is proprietary technology. By this definition, even proprietary technologies such as Windows and DOS are open.

Vendors who invest in an open strategy of choice enjoy high growth. By never investing in proprietary networking protocols like IBM did with SNA and Digital did with DECnet, and by making Unix one of its most important operating systems, HP has seen 30 percent growth while other minicomputer makers have run for their handkerchiefs. Novell, by offering NLMs as an integral part of NetWare, has created an industry around itself. Clearly, Microsoft and Intel are the kings of this open approach.

Router industry leaders such as Cisco, Wellfleet, 3Com, and Proteon take the second approach. By providing multiple protocols such as TCP/IP, IPX, and AppleTalk on one hardware platform—instead of only supplying their own protocol or even



**The open systems
that you really need
have a smattering
of proprietary
technology.**

a single standard protocol—they offer network managers choice and options. The hub vendors have taken this approach as well, offering freedom and choice for physical and logical networking.

If a vendor doesn't offer choice, it will champion a standard. More often than not, though, this standard will come with proprietary extensions that will make it less standard. The other trap is a vendor offering both a standard and its own proprietary approach hidden under the thin veil of choice. We see this all the time: Cisco offers both protocols—IGRP and OSPF, IBM offers AnyNet—multiprotocol support on different operating systems like OS/2. (Thus IBM yields access to mainframe applications via such protocols as SNA and APPN as well as IPX and TCP/IP, and now Novell with access to NetWare via IPX and TCP/IP.)

The pitch from vendors like Cisco and IBM goes like this: "We support and provide both open standards and our own proprietary or legacy technology to help you move from where you are to the open-system nirvana of tomorrow." But tomorrow never comes. Invariably, the proprietary technology is where the features, functions, performance, and margins are. It's no wonder that Cisco's IGRP will operate better than OSPF or that file transfers will be faster over DECnet than over TCP/IP. Over time, the facade of open systems will give way to account control and vendor lock-in.

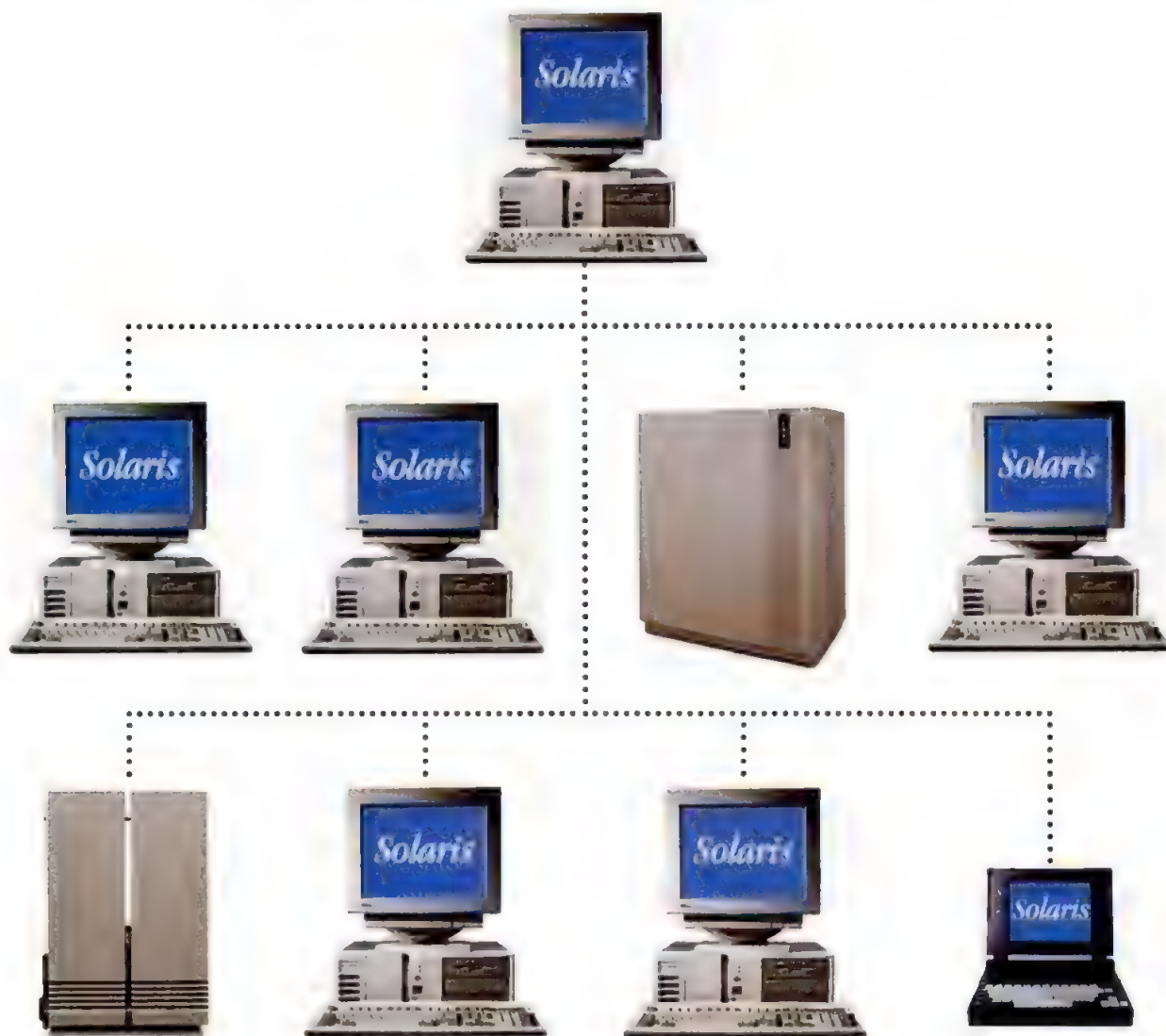
So which camp does Digital fall into? Not sure. It may fall somewhere squarely in the middle.

The best thing that you can do is define an enterprise network architecture. An architecture provides a blueprint and guides investment. A user-driven network architecture will obtain convergence on key interfaces of the four primary enterprise network domains; physical, logical, management, and distributed services. Interfaces, above all, are stability points within networks. Some of these interfaces may be open standards, others may be proprietary. The key point is that the network manager and users choose with their eyes wide open.

The boxes may change, but if you pick the right interfaces to comprise a network, its structure will remain constant during the change. By engaging in the process of network architecture definition, you will make interface choices openly, reducing the chances of being locked into a vendor's open network, even if that network is from Digital.

NICK LIPPIS is a contributing editor for *PC Magazine* and is president of Strategic Networks Consulting, a consultancy specializing in enterprise networking. He is also publisher of *The Internetwork Advisor*, a monthly newsletter.

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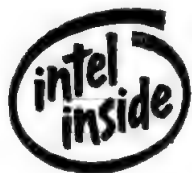


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Disaster Planning: 911 for Your Networks

David, a lot of our readers shake their heads and cluck their tongues at international and local disasters of all kinds, but they don't take even the most elementary precautions against losing their businesses or jobs to a disaster. And the natural terrors of flood and earthquake have been joined by man-made terrors of gunmen, bombers, and computer hackers.

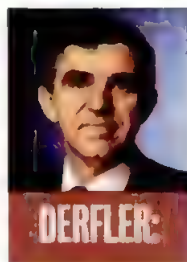
Dear Reader, when your place of business becomes last night's crime scene, what are you going to do—just fade away as another statistic? You need a disaster plan—a network survival plan—to avoid unemployment.

Information technology makes it possible to restructure business. We now have flatter organizations with less hierarchical structure, fewer people, and a pressing need to communicate. If you lose the network, you rip the backbone out of the organization. If you replicate the network operation, you're open for business and proclaimed a hero.

What kinds of issues should you be thinking about in developing a plan? On the strategic side, do you need a complete alternate operating location? Remember, a fire ten floors below you can keep your people out of work, but with a few phone lines and computers they can continue operation at some other site. How about moving in for a while with a supplier, subcontractor, or even a competitor? They all speak your language and can understand the need for mutual support. Make a plan.

On the tactical side, you can start by answering a simple question: Where is your backup software? Sure, you make backups regularly and presumably you even store the tapes at some off-site location, but where is the package containing the disks you must install before you can restore the data from the tapes? Oh, it was on a shelf above the server? More than one network manager has been thwarted by having a perfectly good backup tape with no backup software on hand. Make a plan.

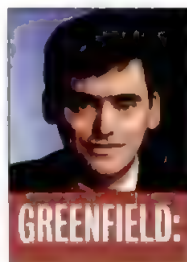
Your plan should be a physical thing in human-readable form. A three-ring binder with a bright red cover is dandy. Scatter copies around the office, in your bank's vault, and in employees's homes. Distributing the plan does make it harder to update but it also makes it harder to destroy completely. Make a plan.



When your place of business becomes last night's crime scene, what are you going to do—fade away?

I couldn't agree with you more, Frank. If the earthquake in L.A. illustrated anything, it was how disaster can be an opportunity for you network managers to prove just what valuable resources you are. But just how are you going to create the master plan that makes you a hero? The answer is simple: Through software, of course. (What did you expect us to say?)

A number of software packages help you step through the creation of a disaster recovery plan. A few vendors, such as Chicor, SunGuard Recovery Services, Comdisco, and Advanced Information Management, offer products developed around powerful relational databases that give you the ability to catalog and track the critical resources and assets of your entire business.



But just how are you going to create the master plan that makes you a hero? Through software, of course.

The packages, which range from \$3,000 to \$6,000, provide a good introduction to the arcane world of disaster recovery. First, they lead you through a series of questions to help you determine which resources you'll want to restore—and I don't just mean data, Frank. There are a whole host of services that need to be evaluated, perhaps the most obvious being your telephone lines.

These packages help you develop a complete methodology for restoring your company's resources. They help you develop a database that includes information about your company like who works where, what equipment each person uses, what business activities need to be supported by the technology, and some of the general decisions that would have to be made in the event of a disaster.

Finally, the packages will leave you off with the printed action plan for that red ring binder you mention, Frank. The plan details how you might respond to a variety of problems ranging from losing a single computer to losing the entire office. Since it's quite likely that you won't have all the information you need on hand, the action plan will often include critical data—like the phone numbers of your company's ten major accounts—that you need to keep your business running.

Of course, software is never sufficient. As you say, Frank, one needs to select an alternate site to set up temporary operations. But at least with the right plan in place, you can change this disaster into a blessing.

So, you must be the guy in charge of software licenses.

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User-to-User

BY NEIL J. RUBENKING

DoubleSpace Difficulties

As soon as I installed DOS 6.0, I used the DoubleSpace command to compress my hard disk, which created C: (the compressed volume) and I: (the uncompressed volume). Given my new latitude, I decided to increase the size of my permanent Windows swap file.

I ran the 386 Enhanced module in Control Panel, pressed the Virtual Memory button and the Change button. Then I checked the Use 32-Bit Disk Access box, selected Permanent, and filled in the size I wanted. Concentrating on making a decision about size, I hit Enter without changing the *location* from the default of C:, now a compressed volume.

When I restarted Windows, my system crashed and locked up. Rebooting brought DOS back, but every time I loaded Windows, it crashed after the logo screen. Even reinstalling Windows didn't help. Here's what I finally figured out—after working all day and night!

Using DOS EDIT, I removed two

lines from the [386Enh] section of SYSTEM.INI: PermSwapDOSDrive=C and PermSwapSizeK=<number>. I replaced them with the line Paging=Off to prevent Windows from using a swap file. Now I can start Windows and create a new swap file in the *uncompressed* volume. I hope installing DOS 6.0 was worth all of this work!

Rebecca Ryan
Statesboro, Georgia

► **PC MAGAZINE:** Of course you're not supposed to put a swap file on a compressed drive, but there's no question: It's easy to make this mistake! If you try to recover using the directions above, Windows may tell you it can't create a new swap file, because it thinks the existing swap file belongs to another copy of Windows. In that case, you'll have to

exit Windows and *delete* the existing swap file on the uncompressed drive before you can create a new one. The name of the swap file is 386SPART.PAR, and it has the hidden and system attributes. Double-check that this file is present by using the command DIR 386-SPART.PAR /A. (Adding the /A switch instructs DIR to show files even if their

file attributes would normally keep them hidden.) Use the DOS 6.0 command DELTREE /Y 386SPART.PAR to wipe out the file. Now you can start fresh with a new permanent swap file.

There's one more minor problem—Windows will not let you create a permanent swap file that takes more than half the remaining space on a drive. If you left 10MB uncompressed, you can only create a 5MB swap file. Your best course, then, is to make any changes to the swap-file size *before* compressing the drive and leave it alone afterward.

Easy Exit from Windows

The WinBatch program EXITWIN.WBT (shown in Figure 1) takes advantage of the new Dialog function in WinBatch, Version 4.0, to create a tiny dialog box in the lower right-hand corner of the screen. The dialog box itself is extremely simple, containing a single push button. When you click on the button, the WinBatch file executes an EndSession command, providing an instant exit from Windows. Of course, if you have any

The interesting thing about EXITWIN is the way it switches the input focus away from itself.

Windows applications with unsaved data, they usually prompt you to save your files before they close, and you'll need to manually exit any DOS applications that may be running.

The interesting thing about EXIT-

WIN is the way it switches the input focus away from itself. When you use the Dialog function or any similar user-input function (such as AskYesNo or Message), the program pauses until the user presses the appropriate push button. Normally, the WinBatch dialog box would remain the active window during this time. In EXITWIN.WBT, however,

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EXITWIN.WBT
Complete Listing

```
; EXITWIN.WBT -- Author: Richard Merit

; Places an "Exit Windows" button in the lower-right corner of the screen.

; -----

; If we're being called with a command-line parameter, we're the second
; instance of ourself (recursion). Go down to the label marked "activate".
If param0 != 0 Then Goto activate

; Otherwise, we're just starting out. So hide the WinBatch icon.
WinHide("")

; Tell WBT to close quietly if the user exits Windows while we're running.
IntControl(12, 1, 0, 0, 0)

; Define the dialog format. It's just a single pushbutton in a tiny window.
; This dialog box is designed to appear in the lower right-hand corner of
; the screen if you are using the standard Windows VGA driver, and will also
; be correct for some OEM drivers using large (8514) fonts. If the dialog
; box does not appear in the correct location on your screen, you should
; adjust the "ExitX" and "ExitY" coordinates below accordingly (of course,
; you can change them to make the dialog appear in any location you desire).
; If you make these numbers too high, so the dialog box would be completely
; off-screen, WinBatch may override them and display the dialog box in the
; center of the screen. If this happens, make the numbers a little smaller.
ExitFormat = "WMDLGED.4.0"
ExitCaption = "Exit Windows"
ExitX = 274
ExitY = 225
ExitWidth = 45
ExitHeight = 14
ExitNumControls = 1
Exit$1 = "1, 1, 43, DEFAULT, PUSHBUTTON, DEFAULT, "Now!", 1"

; Parse the name of the currently executing WBT file from our window title
; (eg, "WBT - EXITWIN.WBT") as follows: search backwards for the first space
; from the end of the window title, start with the next character, and
; extract everything down to the end of the title string.
wbtwin = WinName()

space = StrIndex(wbtwin, " ", 0, @BACKSCAN)
wbt = StrSub(wbtwin, space + 1, StrLen(wbtwin) - space)

; Get the name of the currently active window, so that we can restore the
; focus to it later on.
activewin = WinGetActive()

; Run ourself, passing the active window title as a command-line parameter.
; By placing an extra pair of delimiters around the window title, we force
; the second copy of WinBatch to treat it as a single parameter, even if it
; contains spaces (normally, it would get parsed as param1, param2, etc.).
If FileExtension(wbt) == ".EXE" Then RunHide(wbt, "%activewin%")
Else RunHide("winbatch.exe", "%wbt% %activewin%")

; Display the dialog. Wait for the user to press the (only) pushbutton.
Dialog("Exit")

; One last chance for the user to change his or her mind after clicking on
; the Exit button. Comment this line out if you don't want this safety net.
If AskYesNo("Exit Windows", "Are you sure?") == @NO Then Exit

; Do it.
EndSession()

; If we got here, it means that the Windows session didn't end. Either
; there was a DOS window open, or there was a Windows application with
; unsaved data and the user selected "Cancel" at the "Save file?" prompt.
Exit

:activate

; Give the first instance of WinBatch a chance to display the dialog.
Yield

; Now take the focus away from our dialog box by activating whichever window
; had previously been active (assuming it's still there).
If WinExist(param1) Then WinActivate(param1)
```



Figure 1: This WinBatch program provides a quick exit from Windows at the press of a button.

we don't want to press the button right away; we want to place the dialog box unobtrusively off in the corner and continue with other tasks. This is accomplished as follows:

- When EXITWIN.WBT is first

**EXITWIN.WBT is the
latest in a long series of
utilities providing a fast
exit from Windows.**

launched, it does not receive any command line parameters. Therefore, the If statement at the beginning is false, and EXITWIN continues processing.

- Right before processing the Dialog command, the program runs a second copy of itself, but this time it passes a parameter on the command line. That parameter is the title of the window that was active just before the WinBatch dialog box became the active window.
- When the second copy of EXITWIN starts, the If statement at the beginning

is true, so control branches to the label *activate*. This happens at the same moment the first copy of EXITWIN is displaying the dialog box, so a Yield command is placed just after the activate label to ensure that the dialog box has a chance to be displayed.

- At this point, the first copy of EXITWIN is displaying the dialog box, and that dialog box is the active window. The second copy of the program now activates the previously active window and then exits, leaving the first copy of EXITWIN.WBT waiting in the background.

Just put EXITWIN.WBT in your Startup group for an easy way to get out of Windows.

*Richard Merit
Seattle, Washington*

► **PC MAGAZINE:** The several methods available for exiting Windows aren't the most cumbersome procedures in the world. It appears, however, that when people want out of Windows, they want out *now*. EXITWIN.WBT is the latest in a long series of utilities providing a fast exit from Windows.

Batch files under DOS all use the

same batch file processor—COMMAND.COM itself. Windows has no default batch file processor, so a number of different products are available from third parties. EXITWIN.WBT was written using WinBatch, from Wilson WindowWare, and it requires the WinBatch support DLLs to function. The compiled EXITWIN.EXE, which does not require WinBatch, is available from PC MagNet, archived as EXITWI.ZIP. To get an evaluation copy of WinBatch itself, download WB-40K.ZIP from Library 15 of CompuServe's WINAPA Forum.

Be forewarned that EXITWIN.WBT will fail if the window that is active at the time the batch loads has single or double quotes in its title. If the preceding program in your Startup Group is called Fool's Errand or J.R. "Bob" Dobbs, make sure EXITWIN gets executed first. Items in the Startup group are executed in the order they appear in the window, left to right and top to bottom, so just put EXITWIN in the top-left corner of the window.

If you've written useful batch or script files for Windows, submit them to User-to-User. DOS isn't dead, but Windows is very much alive, and we'll be including Windows batch files from now on. □

Tutor

BY JEFF PROSISE

The Magic of DDE

On the surface, it seems like magic. You hot-link the distance between two points in an AutoCAD drawing to a cell in an Excel spreadsheet, and whenever you change the cell's value in the spreadsheet, the AutoCAD drawing changes, too. This has nothing to do with magic; rather, it is one example of *dynamic data exchange*—better known as DDE.

DDE is one of the things that makes Windows Windows. It's a mechanism that allows disparate applications to establish channels of communication and transfer data in a format that each can understand. DDE is one of three forms of interprocess communication that Windows supports, the other two are the Clipboard (which we could contrast to DDE by calling it *static* data exchange) and shared memory. You find examples of DDE everywhere in Windows, even in the unlikeliest of places. The Paste Link commands supported by many large-scale Windows applications rely on DDE. Even when you start a DOS application in an Enhanced mode DOS window, the Windows program (named WINOLDAP) that manages the DOS app determines what icon to display when the app is minimized, what the program's working directory is, and what to display in the app's title bar through DDE with Program Manager, where these properties are assigned. Even installation programs manage to get in on the act. When a setup program creates new program groups and program items in Program Manager, it typically does so by sending commands such as CreateGroup and AddItem to Program Manager via DDE.

DDE is poorly understood by most Windows users and sometimes even feared. If its reputation is formidable,

that's because DDE can be exceedingly difficult to implement if you're a programmer. But most of us are not programmers, and DDE is relatively painless to apply at the user level. Our mission, therefore, is to learn what DDE is, how it works, and how it is used.

DDE BASICS DDE is based on message transfers, which, as you probably already know, form the very foundation upon which Windows is built. Nearly every action that a Windows program performs happens in response to a message. For example, when a program needs to repaint a window, Windows sends it a WM_PAINT message. If the user selects Close from an application's system menu or double-clicks the system menu box in the window's upper-left corner, Windows sends the program a WM_CLOSE message, which says, "Terminate yourself." A WM_DESTROY message indicates that a window is about to be destroyed (usually because the application itself called the DestroyWindow API function). The list could go on and on. In all, Windows 3.1 defines more than 200 different message types, and programs are free to create additional, application-specific message types if they wish. Nine of these 200-plus message types are reserved for DDE. These messages and their meanings are summarized in Figure 1.

DDE between two applications consists of a *conversation* using DDE messages. In a DDE conversation, the program supplying the data is called the *DDE server*, while the program requesting the data is called the *DDE client*. The

client identifies the data it wants by supplying an *application name*, *topic name*, and *item name*. The application name identifies the program that the information is being requested from (the server), the topic name identifies a category of data, and the item name identifies a particular piece of data in that category. When you type STOCK^NYSE!IBM into an Excel spreadsheet, you're asking Excel to fill the cell with a data item named IBM from a DDE server named STOCK. NYSE is the topic name; the STOCK server may support other topic names, such as NASDAQ and AMEX.

In a DDE conversation, the nature of the messages being exchanged depends on the link type and the content of the data being transferred. Windows defines three types of DDE links: *cold*, *hot*, and *warm*. In a cold link, the DDE client requests an item of information from the DDE server, and the server responds by transmitting the data. The link is normally terminated once the transfer is complete. Hot links and warm links, by contrast, are open-ended. When information is transferred via

*DDE can be exceedingly
difficult to implement
if you're a programmer,
but it's relatively painless
to apply if you're an
ordinary user.*

a hot link, the client asks the server to send a new data-item value whenever that item's value changes. The client, therefore, can update its own representation of the information in real time. A warm link combines elements of both hot and cold links. As in a hot link, the client

asks the server to notify it whenever the value of a particular item of data changes. But rather than sending the new data item value, for a warm link the server simply notifies the client that the value has changed. It's up to the client to request the actual data-item value later on. The process used to retrieve the value is similar to the one for a cold link.

Figure 2 illustrates a typical flow of messages between a DDE client and a DDE server when the client requests a single item of information from the server via a cold link. (The actual message pattern may vary somewhat, be-

DDE Messages

Message	Description
WM_DDE_ACK	Acknowledges receipt of a DDE message
WM_DDE_ADVISE	Establishes a data link between a DDE server and a DDE client by requesting that the server advise (notify) the client when a data item changes
WM_DDE_DATA	Sends an item of data to the DDE client
WM_DDE_EXECUTE	Sends a command string to the DDE server
WM_DDE_INITIATE	Initiates a DDE conversation
WM_DDE_POKE	Sends an item of data to the DDE server
WM_DDE_REQUEST	Requests an item of data from the DDE server
WM_DDE_TERMINATE	Terminates a DDE conversation
WM_DDE_UNADVISE	Terminates a data link established with WM_DDE_ADVISE

Figure 1: These nine messages are used to initiate, carry on, and terminate DDE conversations between DDE servers and clients.

cause the DDE protocol is not rigidly defined.) The client initiates the conversation by broadcasting a WM_DDE_INITIATE message to all active applications, identifying the server it wishes to connect with and the topic of information that it desires. The server, if present, acknowledges the WM_DDE_INITIATE message with a WM_DDE_ACK message. The client sends a WM_DDE_REQUEST message identifying the data item that it desires, and the server responds with a WM_DDE_DATA message containing the item's value. (More precisely, the WM_DDE_DATA message contains an identifier for a shared-memory object from which the client may obtain the item's value.) If the server can't fulfill the client's request, it has the option of sending a negative acknowledgement via WM_DDE_ACK. The conversation ends when the client sends the server a WM_DDE_TERMINATE message, which the server acknowledges with a WM_DDE_TERMINATE message of its own.

Message traffic in a hot link is illustrated in Figure 3. After initiating the conversation with a WM_DDE_INITIATE message, the client sends the server a WM_DDE_ADVISE message, asking the server to notify it when the value of a specified data item changes. Whenever the value changes, the server sends the client the new value via a WM_DDE_DATA message. If the client no longer wishes to track the value of the data item, it has the option of breaking the hot link with a WM_DDE_UN-

ADVISE message. As with a cold link, the conversation ends with a pair of WM_DDE_TERMINATE messages. The client is not limited to one data item and can register hot links for several by sending a WM_DDE_ADVISE message for each. When a WM_DDE_DATA message arrives, it contains information identifying the data item that changed as well as the item's new value.

Figure 4 depicts the flow of messages in a warm link. The key difference between a warm link and a hot link is that the WM_DDE_DATA message that is sent when a data item changes does not contain the item's new value; it merely identifies the item that changed. In effect, the message says, "The item you're interested in has changed. Let me know if you want the new value." When it needs to, the client sends a WM_DDE_REQUEST message, and the server responds with a WM_DDE_DATA message indicating the new value.

Though conceptually simple, DDE is rarely trivial to implement in code. The

options associated with DDE messages are numerous, and message traffic doesn't always follow the neat patterns outlined in Figures 2, 3, and 4. Every application that supports DDE seems to support it differently. There's also the issue of data format. A client application often cannot understand the native data format employed by the server, so some common ground has to be established. The DDE protocol defines several different data formats, ranging from text to bitmaps to metafiles, but the text format is far and away the most often used. To simplify things a bit, the Windows Software Development Kit (SDK) contains a DLL called the Dynamic Data Exchange Management Library (DDEML). The DDEML manages many of the aspects of DDE conversations itself so that DDE applications don't have to. The next step beyond DDEML (and probably the future of Windows itself) lies in Object Linking and Embedding (OLE), a complex protocol that uses DDE conversations to manage compound documents—for example, documents that combine charts created in a graphics program with text created in a word processor.

Dynamic Data Exchange via Cold Link

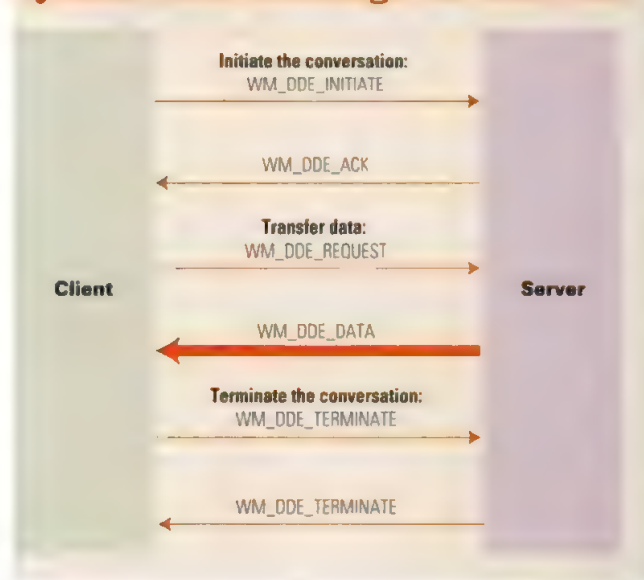


Figure 2: A cold link transfers information through WM_DDE_DATA messages that pass from the server to the client in response to WM_DDE_REQUEST messages from the client. The conversation starts when the client broadcasts a WM_DDE_INITIATE message identifying the server it wishes to connect with and the type of information it desires, and a server responds with a WM_DDE_ACK message. The conversation ends when the applications exchange WM_DDE_TERMINATE messages.

Dynamic Data Exchange via Hot Link

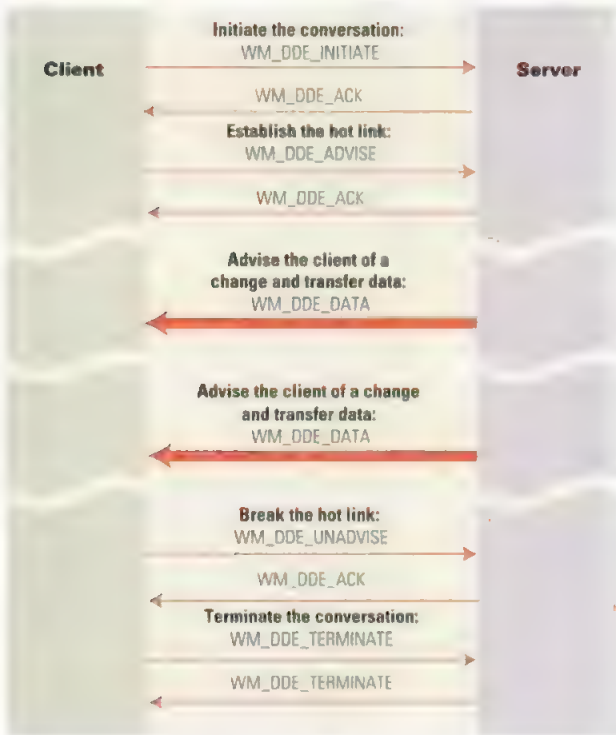


Figure 3: After a hot link is established, the server sends a new data value to the client whenever the value of the associated data item changes. As a result, the client can update its representation of the information in real time.

HANDS-ON DDE Any attempt to illustrate DDE hands-on is going to be complicated by the fact that not all applications support DDE, and not everyone owns copies of applications that do. Nevertheless, this column would hardly be complete if I didn't at least try to give some examples of DDE in action.

For starters, try this simple experiment if you have Microsoft Excel and Microsoft Word for Windows. (If you have Quattro Pro for Windows or Lotus 1-2-3 for Windows and WordPerfect for Windows or Ami Pro, this experiment will work just as well.) First, start the spreadsheet program and enter a numeric value of your choice in a cell. Then choose Copy from the Edit menu to copy the value to the Clipboard. Next, start your Windows word processor and open or create a document. In WinWord, select Paste Special from the Edit menu, specify Unformatted Text as the data type, and click the Paste Link button. (For the other word processors, you can just choose Edit^Paste Link.) The num-

ber should now show up in the word processing document. (If some strange-looking text shows up instead, go to the View menu and make sure that Field Codes is not checked.) You just created a hot link between your word processor and spreadsheet. To verify the link, go back to the spreadsheet and change the cell's value. Within a second or two, the value should change in the word processor, too.

If you could monitor the messages flowing back and forth between the programs (there are utilities that allow you to do just that), you'd see a flurry of WM_DDE_INITIATE messages as your word processor tried to establish contact with a DDE server. Once contact was made, you'd see the hot link requested with a WM_DDE_ADVISE message from the word processor and granted with a WM_DDE_ACK message from the spreadsheet program. When the value changed in the spreadsheet, you'd see the spreadsheet program send a WM_DDE_DATA message to the word processor and receive a WM_DDE_ACK message in re-

Dynamic Data Exchange via Warm Link

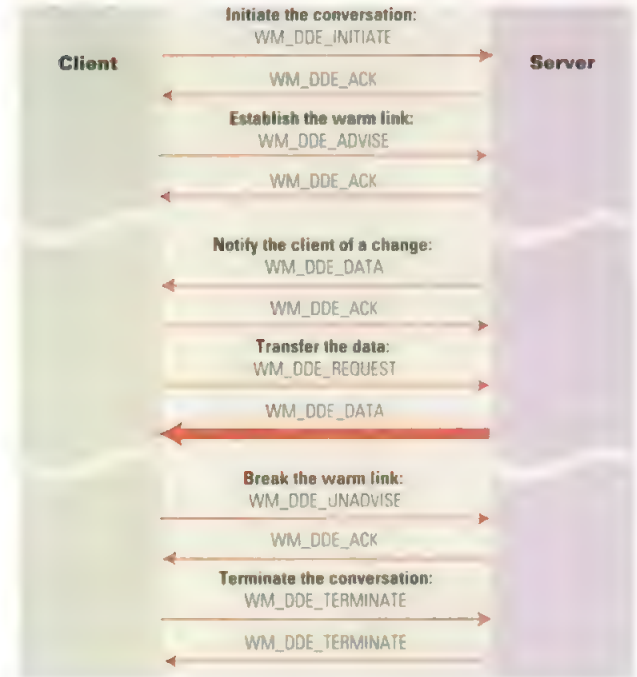


Figure 4: Warm links are similar to hot links in that the server notifies the client when a data value changes. Rather than sending the new value, however, the server simply lets the client know that the value has changed. The client can obtain the new value using a WM_DDE_REQUEST message.

turn. If you later deleted the text from the word processor and there were no other hot links serving the two programs, you'd see the conversation end with a pair of WM_DDE_TERMINATE messages.

The second example requires only Word for Windows. You're going to create a short WordBasic macro that uses DDE to obtain a list of every program group currently defined in Program Manager. When executed, the macro inserts the list of names into the active word processing document. (If you're not sure how to create WordBasic macros, reread the December 7, 1993, Tutor column, or consult your Word for Windows user manual.) Here's the macro listing:

```

Sub MAIN
  Channel = DDEInitiate("Progman",
    "Progman")
  GroupList$ = DDERequest$(Channel,
    "Groups")
  DDETerminate Channel
  Insert GroupList$
End Sub
  
```

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How does it work? WordBasic's DDE-Initiate function starts a DDE conversation. The first parameter passed to the function is the (server) application name, and the second parameter is the data topic. Program Manager is a DDE server ("Progman"), and it lumps group information under the topic "Progman." DDEInitiate returns a channel number that is used in subsequent DDE commands. The command

```
GroupList$ = DDERequest$(Channel,  
"Groups")
```

requests the "Groups" data item, which is a string consisting of the name of every group, separated by carriage return characters, and assigns it to the string GroupList\$. The DDETerminate command closes the channel (in other words, it ends the conversation), and the Insert command inserts the string into the active

*DDE programming is
easy if the language
you're using provides
high-level DDE support.*

document at the current cursor location. This exercise is not overly practical, but it does serve to illustrate how DDE is carried out between two programs. It also demonstrates how easy even DDE programming can be if the language you're using provides high-level DDE support, as WordBasic does.

FURTHER READING If you're interested in learning more about dynamic data exchange, read chapter 17 of Charles Petzold's seminal work, *Programming Windows* (Microsoft Press, 1992). This chapter describes how DDE works, and it presents source code for DDE client and server programs. You may also care to check out chapter 8—Integrating Applications: the Clipboard, DDE, and OLE—of Craig Stinson's *Running Windows 3.1* (Microsoft Press, 1992), which does a wonderful job of explaining DDE and OLE in terms that everyone can understand. □



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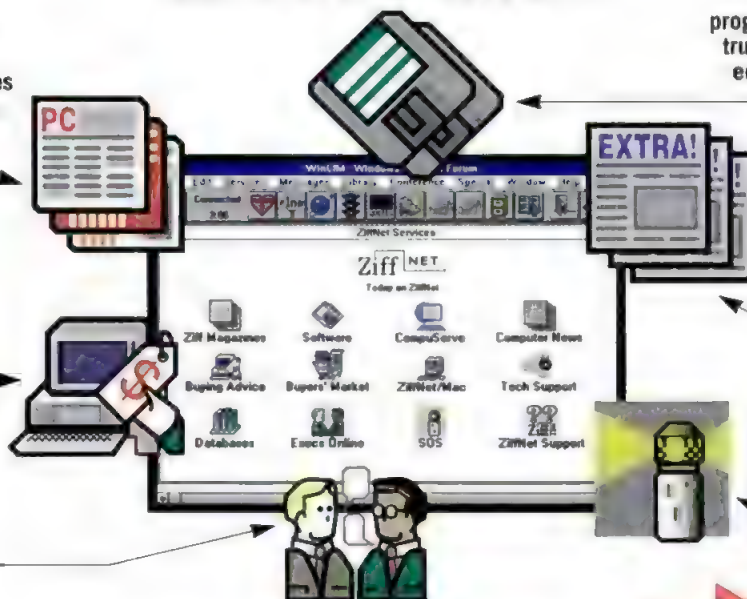
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Corporate Developer

BY FRED GAULT

Digital Video as a Data Type

Just as corporate developers have become accustomed to working with text as a data type, they now hear the ever-increasing demands from users to store and manipulate new types of information. Desktop computing power has finally reached the point where you can display images with photographic resolution and color fidelity, play stereo sound to rival a CD, and display video right on your monitor. "If a picture is worth a thousand words, then a movie must be worth a million, right?" asks the corporate executive. Is your workstation hardware and LAN configuration ready for digital video? Do you have room to store digital video? Read on for the surprising answers.

WHAT IS DIGITAL VIDEO? Digital video is binary data that represents an animation or video sequence. It may optionally contain a synchronized sound track. Our discussion of this data type can be generalized to sound and still images. A sound file can be a digital movie with just a sound track and no video track. A still image can be a digital movie of just a single frame.

Unlike analog video—that is, what you see on television or record with your camcorder—digital video has all the advantages of computerization. You can duplicate it without loss of quality, categorize it for easier recovery, and store it away in a database. Most importantly, digital video is randomly accessible. For instance, when you sit slack jawed in front of "Laverne and Shirley," you observe the broadcast as it progresses from start to finish. If you record the program on your VCR, you can fast forward and re-

wind, gaining some control over the order in which the action is watched. But if you record the program digitally and store it on a random access device, such as your hard disk, you could skip instantly to any moment in the show.

SO WHAT? But who cares to watch "Beavis and Butt-head" with instantaneous pinpoint digital control? Let's pick a more relevant example. Suppose you're building a fleet-maintenance system for all the trucks in your company. Wouldn't it be nice if a video clip of each repair process were available at the touch of a key? As crews work on the trucks, they can review each step in the repair process. If necessary, they can look at a short clip that shows exactly what that triangular muffler bearing looks like. But wait, there's more!

NAVIGATIONAL MOVIES With instant random access to any frame in a digital clip, you can do things never before possible. Consider the navigational movie—a series of still images, each one a frame in the digital clip, organized to let the user look around in a space. We can film the interior of a room, being careful to collect images for all 360 degrees as well as up and down. By using a program that skips instantly from frame to frame, you can look around the room in any direction you wish. This technique isn't possible with analog video tapes, because it takes

too much time to rewind and fast forward the tape. Going back to the fleet maintenance example, imagine that you have navigational movies of each mechanical part of a truck. A repair crew can view a part from any angle, looking around in the navigational clip. In many cases, video clips communicate more information than a screen full of text.

CORPORATE COMMUNICATION New methods of communication are possible with digital video. Just as voice mail has changed the way you use the telephone, digital-video clips will change the way you work in your office. We think of electronic documents as paper documents stored in the computer, and if you want a document, you just print it out. But you can't print out a sound. Color images can be printed, but how do you print out a movie? Digital video is another step towards the long-promised paperless office.

When the telephone was invented, many people thought that sending a handwritten note was all that was needed for business communication. It was difficult for people at the turn of the century to imagine how the telephone would come to be a part of daily life. More recently, the desktop computer revolution swept through the business world like a hurricane, changing the workplace in ways few people predicted. Now a similar revolution is occurring with digital video.

No industry will be untouched. Documents will consist of text, sound, still images, and digital video. Insurance companies will attach movies of damaged property to the electronic claim document. Police officers will include movies of the crime scene in their reports. Real-estate companies will have panoramic navigational movies of properties for prospective buyers. And even in Hollywood, where digital special effects have been around for years, everything will become digital, allowing instant access to any frame in the history of cinema. One day, look for your CEO's company-wide address to the troops as a digital-video clip available on

Are your workstation hardware and LAN configuration ready for digital video? Do you have room to store digital video? The answers might surprise you.

the company network.

WHO ARE THE PLAYERS? There are two significant desktop digital-video engines, Apple's QuickTime (and QuickTime for Windows) and Microsoft's Video for Windows. Video for Windows is sometimes incorrectly referred to as AVI (Audio Video Interleave), referring to the name of its file format. While there are other technologies available, these are the serious contenders for dominance on Macintosh and x86-based personal computers. QuickTime, QuickTime for Windows, and Video for Windows are "software only," meaning that no special hardware is required to playback digital movies. Although hardware-assisted playback is possible, few desktop computers are outfitted with the necessary hardware.

Missing from this discussion is Autodesk's FLI/FLC animation standard, because it doesn't have integrated audio and doesn't support the latest compressors (described shortly). Similarly, DVI is a hardware-assisted video standard that has been eclipsed by software-only technologies. IBM's digital-video technology is called UltiMotion and is meant for the OS/2 market. Both QuickTime for Windows and Video for Windows play on the OS/2 desktop via OS/2's included Windows support.

APPLE'S QUICKTIME QuickTime on the Macintosh and QuickTime for Windows on x86-based personal computers use a powerful technology that is already well known by folks who use Macintosh computers over in the desktop publishing department. What is nice about QuickTime is that digital movies are playable on both Mac and Windows machines without conversion. The downside is that Apple markets QuickTime for Windows through the Apple Developers program, which has resulted in near invisibility in the Microsoft Windows marketplace.

QuickTime has been around for a while and has been through two up-

grades. It has grown up to include some elegant and useful features. One such feature is multiple tracks. A QuickTime movie can have multiple sound tracks (for example, in different languages) and multiple video tracks (helpful in video-editing). QuickTime also supports synchronized text (such as subtitles) that can appear in the movie. QuickTime's maturity makes it a robust

QuickTime for Windows a slight performance edge over Video for Windows.

MICROSOFT'S VIDEO FOR WINDOWS Microsoft announced Video for Windows on the same day and in the same place that Apple announced QuickTime for Windows! Video for Windows enjoys the advantage of Microsoft's marketing muscle. It is not available on the Macintosh, but it comes with a Macintosh program that will convert QuickTime movie files to Video for Windows movie files, which then may be played on Windows. Microsoft chose a frame-based model, in contrast to QuickTime's time-based model, which limits Video for Windows to a subset of QuickTime's features. For example, you can't have a frame (or group of frames) remain on the screen for a different amount of time with Video for Windows, as you can with QuickTime.

The file format used by Video for Windows is called AVI. AVI—like QuickTime—is capable of supporting multiple tracks, but the current release of Video for Windows doesn't take advantage of this. Microsoft is currently working on an upgrade.

SOFTWARE SUPPORT Any desktop machine that you want to handle digital video must have a digital-video engine available. For the Mac, this comes as an integral part of the operating system. For Windows, it's not so simple. You must provide the playback engine for either QuickTime for Windows

or Video for Windows, and both may coexist on the same system. You acquire these products either from the manufacturer or with a third-party software product that supports digital video. Many third-party software products support digital video, mostly on the multimedia end of the spectrum: movie editors, sales presentation products, and so on.

TECHNICAL ISSUES What do you need to understand about digital video as you implement projects that involve digital video in your corporation? In a nutshell,



Figure 1: These images show the effects of lossy compression. Figure 1A shows a movie frame of this column's author "shopped" at 10 frames per second with the Cinepak lossy compressor. For a constant data rate and frame size, the compressor has to degrade the image in order to stay within the required data rate when more frames per second are requested. At 30 frames per second (Figure 1B), a slightly fuzzier Fred.

platform for video development and playback.

QuickTime for Windows is essentially a playback-only port of the Macintosh product. Consequently, it doesn't offer the full feature set available on the Mac. Apple has officially stated its intention to continue upgrading QuickTime for Windows. It has proven popular with CD-ROM developers who tend to write their products on the Mac yet wish to release their products on both the Mac and Windows. Trade-press lab reviews have given

digital-video files are really big! I mean huge. They gobble up acres of disk space and take too long to move over a network.

For a concrete example, let's create a short (30 second), color video clip with a sound track. Due to current hardware constraints, let's assume a realistic frame size will cover only one-quarter of our 640-by-480-pixel screen. Further assume that the clip includes a modest 8-bit (256 color) movie with an acceptable 8-bit, 11-

how much data it takes for that same 30-second movie using the entire 640-by-480 frame with 24-bit color and 44-Khz, 16-bit stereo sound? Nope, you're way too low. The answer is 835 uncompressed megabytes for 30 seconds of video! Is digital video realistic? How can you prevent it from overwhelming your databases and workstations? Compress it!

COMPRESSION The obvious answer to movie bloat is to compress the movie. Both QuickTime and Video for Windows

3.1 is available for IBM's UltraMotion digital video for OS/2. If your shop has both Macintoshes and x86-based PCs, it is important to use compressors that are available on both platforms. When converting movie files from one platform to another, make sure the video bit stream was compressed with a codec supported on the target machine. It's possible to convert a movie only to discover that it won't play, because the decompressor required doesn't exist in the target environment.

PLAYBACK PERFORMANCE Storage and network-capacity issues aren't your only concerns. Desktop hardware capabilities and movie construction must be considered as well. Let's look at the parameters that affect video playback.

The Movie. First, how was the digital movie constructed? Typically, after digitization from an analog source, a movie must be "shopped" (named after the famous Mac program MovieShop). This shopping process sets the digital clip's inherent characteristics. These characteristics include the frame rate, the transfer rate of the delivery mechanism (for example the CD-ROM's data-transfer rate), and a variety of other esoteric parameters. If this process is bungled or the clip is designed for playback criteria beyond the hardware's capabilities, performance will suffer. The codec used to compress the movie is also very important. A crummy codec that produces a bloated file can aggravate bandwidth bottlenecks. A good codec yields a tightly compressed file that decompresses elegantly, lightening the load on the CPU.

The LAN. Next, keep in mind that the delivery mechanism has a finite peak data-delivery rate. If your movies are stored on a network server, the available network bandwidth dictates the maximum playback speed. Although movies can be played over a LAN, performance will be unpredictable unless you purchase a video server. The video server provides special bandwidth reservations and streaming buffers. LAN server buffers are designed to cache frequently used records. For digital video purposes, this is actually counterproductive; video playback requires buffers that can discard data rapidly, because it's unlikely that a frame will be reused as the movie plays sequentially.

CD-ROM. If you read movies from a

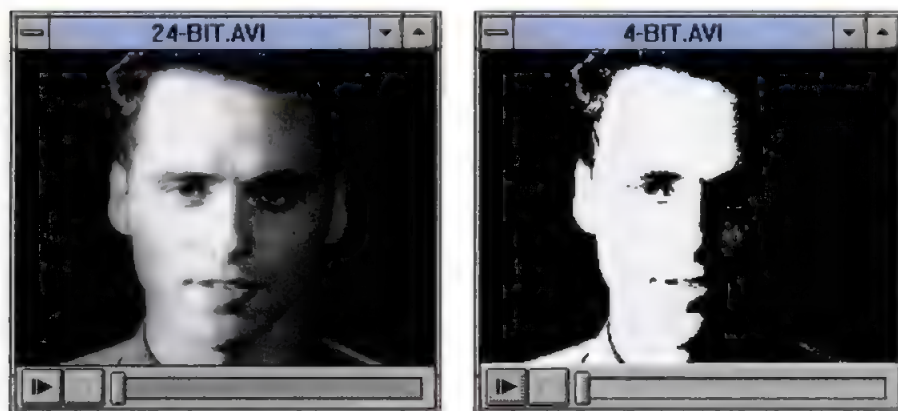


Figure 2: These images illustrate the dramatic difference in image quality between different Windows drivers. On the left is a frame from a Video for Windows clip using a 24-bit Windows video driver. On the right is the same clip at VGA (4-bit) resolution.

kHz monaural sound track. To make it even easier, we'll use a frame rate of only 15 frames per second—considerably fewer than the normal 30 frames per second, which is considered full motion.

Check out these numbers: 320-by-240-pixels per frame equals 76,800 pixels per frame, times 15 frames per second equals 1,152,000 bytes per second. Add 11,000 8-bit sound samples per second and you get a total of 1,163,000 bytes per second for your 30-second movie. Who's going to tell the CEO that his speech to the troops (at just under 35 megabytes) can be only 30 seconds because of disk space?

It's important to take away several things from this exercise. First, digital movies are huge! Second, sound isn't a significant portion of the clip. Third, to play this small movie at a modest 15 frames per second, you need to move about a megabyte per second through the network to a computer! It's a capacity planner's nightmare. Database administrators and corporate developers take note: Digital movies dwarf the largest of traditional data records. Want to guess

support several types of compressors (known as *codecs*—short for compressor/decompressor). The best codecs for video are *lossy*, which means that for best results, some data is discarded. After reading that last sentence, developers unfamiliar with digital video are probably clutching their pocket protectors in horror. But the eye is easily fooled by rapidly moving images, so if a few pixels are sacrificed to allow a higher frame rate, then it's worth the trade-off. Not all codecs are lossy, as there are circumstances where it is unacceptable to drop data from the digital video. Figure 1 illustrates the effects of lossy compression.

CODECS The most popular codecs in use today are Cinepak by SuperMac Technology and Intel's Indeo 3.1. Each has its strengths and weaknesses. Cinepak is great for playback, but it is very slow for compressing. Indeo is designed for hardware-assisted video capture and playback using Intel's i750 chip. Both these codecs are available for QuickTime, QuickTime for Windows, and Video for Windows. In addition, Indeo

CD-ROM, the CD-ROM drive's sustained data rate becomes the upper speed limit. CD-ROM drive ratings are a lot like gas-mileage ratings on new cars. They look good, but the reality is far different. For example, a single speed CD-ROM drive is typically rated at 150K per second for data delivery. In reality, it's necessary to shop a digital clip at 90K per second to get decent performance, because a CD-ROM drive must perform relatively slow seeks on the disk to locate the digital-video data. In practice, this means that a sustained data rate of about 90K is all that's possible.

Hard Disks. Computer hard disks can occasionally be a factor, but other bottlenecks are more likely to crop up first. As a rule, movies that play from the hard disk perform quite nicely, although few enterprises can justify buying that much disk space for each desktop machine.

Local-Bus Video Technologies. Machine bus speed can be a factor as well. Recent advances in x86-based computers include several local-bus video technologies (VESA's VL-Bus and Intel's PCI) that prevent normal bus traffic from slowing down video activity. Machines based on local-bus video technology afford a significant performance improvement for desktop digital video.

Video Drivers. All modern video cards for x86-based machines come with video-driver software. Most video drivers are designed to work specifically with certain video boards and can have a great impact on video-display performance. As a general rule, asking the video board to display more colors slows down the video-display speed. For instance, a video board displaying 16 colors refreshes the screen faster than the same board displaying 32,000 colors. On the other hand, your digital movie looks pretty lousy in 16 colors (Figure 2).

The 8-bit Windows drivers (256 colors) can cause annoying color flashes as the digital clip asserts its palette. A good compromise is to use the 15- or 16-bit Windows color drivers (32,000 or 64,000 colors, respectively), instead of 24-bit color drivers (approximately 16.7 million colors). Remember that fast hardware demands well-written video drivers. Even the most efficient video driver today can't keep up with the demands of

digital video. Because of this, both VFW and QuickTime for Windows bypass video drivers when possible to get the optimal performance.

The CPU. Finally, you should consider the machine's processor speed. Common sense might suggest that a slower CPU is bad, but the truth of the matter is that low bandwidth in the form of a slow CD-ROM drive, a slow network, or slow system video throughput is likely to create a performance bottleneck long before the CPU is a factor. Having a fast CPU is great, but the CPU's primary job is to decompress each frame's image. It doesn't matter how fast the CPU is if you can't deliver the entire compressed frame fast enough. A numeric coprocessor is no help for digital video because the decompression rou-

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*The advantages of
digital video are
compelling: Expect it to
become an accepted data
type on critical systems.*

.....

tines use integer arithmetic.

Think of digital-video playback performance as a factor of many interrelated parts. It includes bandwidth, encoder compression ability, decoder efficiency (determined by the decoder logic and the processor speed), and the amount of movie data (frame rate, frame size, image quality, color depth, and sound quality). On today's limited systems, this means you must maintain a delicate balance of these factors in order to get decent digital-movie performance.

Frame rate, image quality, and image size all contribute to the number of bytes that must be passed through the system. Available bandwidth, however, limits the number of bytes that you can move through the system (including networks and workstation hardware). You can't maximize all three characteristics; raising one will force you to lower another. Increase the frame rate, and the image quality of each frame degrades. Increase the

size of the movie frame, and you must accept either a lower frame rate or degraded image quality.

RECOMMENDATIONS The least powerful x86-based system for digital video should be a 33-MHz 386 with local-bus video. CD-ROM drives should be of the double-speed variety. For a Macintosh, don't settle for anything less than a IIci. For digital video playback across a LAN, consider a video server. Even with these configurations, don't expect to see more than 320- by 240-pixel frame sizes and frame rates of 15 fps. It goes without saying that more powerful machines are better. Of course, watching paint dry would be more productive than trying to play digital video from a floppy disk or over a modem connection.

For the moment, the compressors that perform best are Cinepak and Indeo 3.1. It may be necessary to capture using an encoder optimized for high-speed capture, then recompress to Cinepak or Indeo 3.1 after the capture. If your corporate environment has a variety of platforms that need digital video, QuickTime is a better choice, because it supports both Windows and the Mac. Currently, no digital-video standard supports all platforms.

If you are designing a system that uses digital video, don't reinvent the wheel and try to write a video playback engine. Instead, just use the playback engines that already exist on the desktop.

SUMMARY Today's desktop computer equipment, office networks, and database storage systems are only now becoming capable of handling digital video, and with the increasing price performance, you'll see ever more capable systems in the workplace. The advantages of digital video are compelling, and you should expect it to become an accepted data type in our critical systems. While digital video will require significant increases in bandwidth and storage, now is the time to begin investigating digital video and preparing for its use. □

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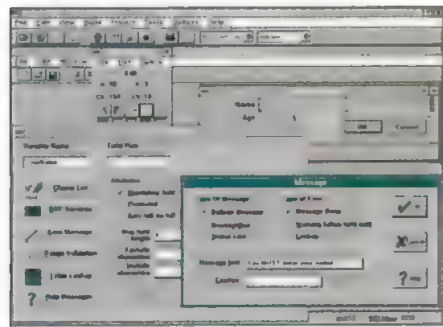
Toolkits

BY NEIL J. RUBENKING

ProtoGen+ Offers Visual Development

ProtoGen+, Version 4.1, is a Windows-based system for prototyping and visual development that generates code for ANSI C, C++ using Object Windows Library (OWL) 1.0, C++ using Microsoft Foundation Classes (MFC) 2.0, and Pascal using OWL 1.0. Free updates for Borland C++ 4.0, OWL 2.0, and MFC 2.5 should be available by the time you read this.

ProtoGen+ (PG+) is actually a suite of tools: the main ProtoGen+ code generator, the ProtoView screen manager, the ViewPaint dialog editor, the WinControl custom control library (a DataTable spreadsheet control is also available), and the menu designer. You can access databases with the optional SQLView library. With the product's open environment, you can specify your choice of text and bitmap editors and snap in Visual Coders. Like Wizards and Experts, Visual Coders gather information about a particular task and then generate the necessary code.



Because the Name field in the MDI dialog box is marked as mandatory, an error message will be displayed if the user clicks OK without filling in that field.

Application frameworks, such as OWL and MFC, manage the mundane tasks of Windows programming, such as creating and destroying windows, registering window classes, and dispatching messages, so the programmer can concentrate on features. PG+ goes further by automatically generating code to handle many common programming tasks. For example, the ViewPaint dialog editor will individually set the font style, font size, color, and 3-D effects for dialog controls. (A standard resource file only allows font settings for an entire dialog box and doesn't include 3-D effects at all.) More important are the *methods* that ViewPaint lets you define for controls. The methods are optional code elements that do such things as associate help text with a control, validate data, and even establish DDE hot links with DDE-aware applications.

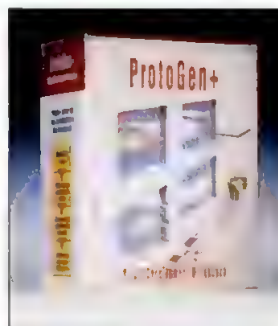
VISUAL DESIGN Popular features such as toolbars and status lines with dynamic help text are directly supported by PG+. To link a toolbar button or menu item to a dialog box, a common dialog, a child window, or even a program requires just a few mouse clicks. MDI support is outstanding: PG+ automatically uses the correct menu for the selected MDI child window and allows dialogs to be MDI child windows. This last is quite a feat, since Windows itself doesn't permit dialogs to be MDI child windows.

PG+ short-circuits the usual edit/compile/test cycle with its ability to simulate the

user-interface portion of the program under construction. If a menu choice is linked to a particular dialog, selecting it will bring up the dialog in the simulation. If the dialog's controls have validation methods defined, those methods will be active in the simulation. Everything except code added by the programmer can be simulated.

As long as you add code only between the markers inserted by PG+, you can continue to work on an application both in PG+ and in another environment. When PG+ regenerates a project, it leaves code between the markers untouched. Since the entire application is stored as source code in the language of your choice, you're not locked into using PG+.

Snap-in Visual Coders make it possible to extend the abilities of PG+. Like Wizards and Experts, they display dialog boxes that gather necessary data from the programmer and generate both prototype information and source code based on that data. PG+ comes with a Visual Coder for the Windows common dialogs, with complete source code and suggestions on how to build your own Visual Coders. Planned additions include Visual Coders for multimedia, MAPI (messaging application programming interface), and OLE (Object Linking and Embedding) 2.0. Also, Crystal Reports 3.0 will come with a Visual Coder to integrate its Report Writer into PG+.



Learning PG+ isn't difficult, but it takes some time. If you can't find an answer in the four substantial manuals or the excellent on-line help, free tech support is available by phone, fax, BBS, and CompuServe. Once you master the environment, however, ProtoGen+ will pay back your investment

with much faster and easier prototyping and program development.

• ProtoGen+, Version 4.1

List Price: *ProtoGen+, Version 4.1*, \$395 (introductory price, \$199); *SQLView library*, \$399; *DataTable spreadsheet control*, \$249. Requires: *Microsoft Windows 3.1*, mouse, *Windows SDK or equivalent*, a compiler that contains *MFC or OWL*. *ProtoView Development Corp.*, 353 Georges Rd., Dayton, NJ 08810; 800-231-8588, 908-329-8588; fax, 908-329-8624.

Circle 444 on reader service card

Utilities

BY PETER G. AITKEN

Synchronize Your Computers with UPDATE

Like many other PC users, I work on two machines: One is at the office, and the other is at home. A busy schedule and a heavy work load mean that I must often take work home with me and then take it back to the office the next day. The data files associated with many of my ongoing projects are regularly schlepped back and forth on floppy disks. Each time I move from one system to the other, I need a way to copy new and modified data files from one computer's hard disk to the floppy disk and then from the floppy disk to the other machine's hard disk. I needed an efficient way to ensure that I'm always working with the latest version of each file.

Until recently I have been using Michael Mefford's DIRMATCH utility for this task. DIRMATCH was published in this column several years ago and is, with good reason, one of the all-time favorite *PC Magazine* utilities. DIRMATCH takes two directories and file specifications as arguments, then displays two lists showing duplicate filenames, with the more recent versions highlighted. You can then manually tag files to be copied from one directory to the other, but the need for manual intervention means you cannot run DIRMATCH in batch mode.

UPDATE does not perform all the functions of DIRMATCH but does allow you to automate file updates. With UPDATE, you can enter a single command and then go do something else while the

program takes care of the task of copying files to and from the transfer floppy disk.

You can get a copy of UPDATE and its source code by downloading it from PC MagNet or by mail, as explained in the sidebar "Guide to Our Utilities and How to Get Them." Once you have downloaded the program, copy it to a subdirectory on your PATH, so you'll be able to run UPDATE from anywhere on your hard disk. To compile UPDATE, you'll need a C compiler that's capable of creating DOS programs. The compiler I used was Microsoft Visual C++ Professional Edition. (The Standard Edition targets Windows programs only.)

UPDATE PATHS UPDATE has two methods of operation. The first method is most useful if you are conscientious about

keeping your data files organized in separate subdirectories by project, subject, and so on. In this case, UPDATE takes two arguments: One argument is the full path of a subdirectory on your hard disk, and the other is the full path of a subdirectory on the transfer disk. For example:

```
UPDATE C:\LOTUS\DATA A:\
```

The order of the arguments does not matter; you could just as well enter

```
UPDATE A:\ C:\LOTUS\DATA
```

Both of these commands will instruct UPDATE to compare all the files in C:\LOTUS\DATA with all the files in the root directory on drive A:. The program will then copy files, as needed, according to these rules:

- If a file exists in only one of the subdirectories, it is copied to the other subdirectory.
- If a file exists in both subdirectories, the time and date stamps of the files are examined. If the stamps don't match, the newer version of the file is copied over the older version.

The end result is that both subdirectories contain the latest versions of all files that were initially present in either subdirectory. When a file is copied, the copy is given the same time and date stamp as the original.

When using UPDATE in this way, the two paths will usually be on different drives (one floppy disk and one hard disk), but they can be on the same drive as long as the paths themselves are different. If you should inadvertently specify the same path for both arguments, the program will display a warning message and exit.

UPDATE DRIVES What if the files you want to transfer are not neatly organized into a few subdirectories but are scattered here and there on your hard disk? Or perhaps you prefer to toss all the files into the root directory of the transfer disk instead of using subdirectories. UPDATE's second method of operation is just what you need. In this case, UPDATE takes the complete path of a subdirectory as one argument and a drive letter as the second argument. The subdirectory will typically be on the floppy disk that you are using to transfer files, and the device will usually

Top 10 Utilities

Rank	Utility
1	MONITOR - Monitors system resources
2	CHANGER - Changes look of desktop
3	WTIME - Keeps PC clock accurate
4	INCTRL - Controls Windows Installation
5	BAT2EXEC - Compiles batch files
6	DRVLOAD - Installs device drivers
7	PCTODAY - Lists files with current date
8	BUGS - Windows 3.1 screen saver
9	FINDIRQ - Locates available IRQs
10	PRN2FILE - Captures printer output

This list is based on the total number of downloads each utility has had on PC MagNet over the past 12 months. To download these files, type GO ZNT:TIPS. For more information, see the sidebar "Guide to Our Utilities & How to Get Them"

be the hard disk you are transferring to or from. For example, the command

```
UPDATE A:\ C:
```

searches your entire C: drive for each of the files found in the root directory A:\. Note that the terminating backslash is necessary to distinguish the root directory from a drive specification. If a matching file is found, UPDATE copies the newer version over the older version. When the target files are scattered among numerous subdirectories on your hard disk, the ability to specify a drive letter can be very handy.

This second method of using UPDATE has some limitations, which you may already have noticed. A file will be updated only if it is present both on the drive and in the subdirectory that are given as arguments to UPDATE. This means that the first time a file is transferred, it must be manually copied from the source hard disk to the floppy disk and then from the floppy disk to the destination. Once this has been done, however, UPDATE will handle future transfers automatically.

UPDATE OPTIONS UPDATE offers three option switches. The /? switch displays a screenful of help information and then exits. The /L switch instructs UPDATE to write a time- and date-stamp record of all copy operations to a log file named UPDATE.LOG. The information in this log can be useful when you need to verify a file transfer or track down the most recent version of a file.

The third switch, /Q (for "quick"), is relevant only when using UPDATE to transfer files between a path and a drive (the second method described above). It's not uncommon for a large hard disk to contain more than one file with the same name located in different subdirectories. When UPDATE finds a file on the drive that is newer or older than the matching file on the path, its default is to ask the user whether to copy the file. If the user answers no, UPDATE continues searching the drive for other instances of the file. If the answer is yes, UPDATE copies the file and then starts searching for the next file. But this prevents using UPDATE in a batch file. With the /Q switch, UPDATE automatically copies the newer version over the older version without querying the user and then moves on to

the next file. Warning: This can be a dangerous option. You risk, for example, overwriting the wrong README.TXT file. Use the /Q option with extreme care.

UPDATE can be run in a Windows DOS session. In fact, that's how I use it most of the time. Each of my transfer disks contains a batch file that executes UPDATE with the arguments appropriate for that disk's files; although the contents of the batch files differ, they all have the same name: BU.BAT. I've added an icon to my Program Manager desktop that executes A:\BU.BAT. To transfer files, all I need to do is slip the disk in drive A: and double-click the icon.

INSIDE UPDATE UPDATE is written in plain old C rather than C++. A program such as this really has no need for the high-powered, object-oriented tools of C++. It was compiled with a stack size of 16,384 bytes instead of the default 2,048 bytes. The reason for this will be discussed below.

Most of the code in the main() function is devoted to dealing with the command line arguments. The code checks for the /? switch, in which case it displays detailed help information, or it checks for the wrong number of arguments, in which case it displays brief help information before exiting. The program then determines whether the parameters are two paths or a path and a drive and then

the log file is opened and the current system date is written to it. Finally, the program is ready to get to the real task of comparing and copying files.

If the user typed two paths on the command line, the function update_path() is called twice, once with the first path as the source and the second path as the destination, then again with the source and the destination reversed. This method is not ideal in terms of efficiency, since on the second call the function will unnecessarily compare files that were already compared (and possibly copied) when the function was called the first time. However, I feel that the simplicity of the method more than offsets the slight loss of speed. The _dos_findfirst() and _dos_findnext() functions are then used to locate files and obtain information about them. Upon finding a matching file, these functions place information about the file, such as its name and its date and time stamps, in a structure of type _find_t (this structure is defined in the header file dos.h). Since we will need the file's date and time information, these functions are very handy.

The function update_path() operates by stepping through all of the files in the source path, one file at a time. For each file, the destination path is scanned for a file of the same name. If no matching file exists, the file is copied from the source to

PSEUDOCODE FOR DIRECTORY SCANNING

Complete Listing

```
scan(directory_name)
{
    do
    {
        get_next_entry();           /* subdirectory or file. */
        if (is_a_file)
            process_file();
        else                         /* must be a subdirectory */
        {
            scan(subdirectory);
        }
    } (until no more entries in directory_name)
}
```



Figure 1: This pseudocode skeleton of the scanning routine shows how UPDATE uses recursion to scan all the subdirectories on a hard disk.

copies the command line arguments into program variables. If the parameters are invalid, the program displays an error message and exits. Next, the program looks for the option switches /L and /Q on the command line and sets program flags accordingly. If the user requested logging,

the destination. If there is a match, the two files' time and date stamps are compared, and the source file is copied over the destination file only if the source file is newer.

The function filecopy() is used to perform the copying (see Figure 1). If the source file has a length of 0 bytes, it isn't

FILECOPY() Complete Listing

```
void filecopy(char *source, char *dest, unsigned date, unsigned time)
/* Copies the file source to dest. If dest already exists, it is
overwritten. The destination file's date and time stamps are
set to the values passed in the arguments date and time, which
must be in the DOS date and time format. */
{
#define BUFSIZE 32767 /* Copy buffer size. */
unsigned bytecount, numwritten; /* Number of bytes copied. */
int src, dst; /* DOS file handles. */
static char FileBuf[BUFSIZE]; /* Buffer for file copying. */
char temp[_MAX_PATH + _MAX_PATH + 20];
struct _dos_time_t ttime;
int i;

/* Make entry in log file if user requested logging. */
if (logfile)
{
_dos_gettime(&ttime);
sprintf(temp, " %02d:%02d: Copying %s to %s\n", ttime.hour,
ttime.minute, source, dest);
if ((i = _write(loghandle, temp, strlen(temp))) == -1)
exit(FILE_WRITE_ERROR);
}

/* Open the source file in read-only mode. */
if (_dos_open(source, _O_RDONLY, &src)
exit(FILE_OPEN_ERROR);

/* Read a bufferful of bytes into FileBuf. */
if (_dos_read(src, FileBuf, BUFSIZE, &bytecount))
exit(FILE_READ_ERROR);

/* Create the destination file only if the source file
contains at least 1 byte. Otherwise close the source
file and return. */
if (bytecount > 0)
{
if (_dos_creat(dest, _A_NORMAL, &dst))
{
_dos_close(src);
exit(FILE_CREATE_ERROR); /* Couldn't create file. */
}
else /* Source file is zero bytes. */
{
_dos_close(src);
return;
}

/* Continue reading and writing until the entire file
has been copied. Exit on file error. */
while (bytecount != 0)
{
if (_dos_write(dst, FileBuf, bytecount, &numwritten))
exit(FILE_WRITE_ERROR);
if (_dos_read(src, FileBuf, BUFSIZE, &bytecount))
exit(FILE_READ_ERROR);
}

/* Set the destination file's date and time. */
if (_dos_setftime(dst, date, time))
exit(FILE_WRITE_ERROR);

/* Close the files. */
_dos_close(dst);
_dos_close(src);
}

/* End of function filecopy() */
}
```



Figure 2: The filecopy() function copies a file from one directory to another and sets the destination file's time and date stamps.

copied. An important feature of the filecopy() function is that it sets the destination file's time and date stamp to match those of the source file (see Figure 1). Without this feature, the time and date stamp would reflect when the copying occurred rather than when the original file was created.

If the user is updating a path to a drive, the program calls the function update_device(). This function also uses _dos_findfirst() and _dos_findnext() to step through the files on the path, one file at a time. Then for each file, the function scan_drive() is called to scan the entire drive for matching files.

SCANNING RECURSIVELY It's worthwhile to take a look at the operation of the directory-scanning algorithm implemented in the function scan_drive(). The task of scanning a drive's entire directory tree may sound complicated, but it's actually quite simple. The trick is in the programming technique of recursion, in which a function calls itself.

How can recursion be applied to the problem of scanning a disk's entire directory tree? Part of the answer lies in the ability of the _dos_findfirst() and _dos_findnext() functions to return information about subdirectories as well as files. These functions form the heart of

UPDATE's scan_drive() function. When a file is encountered, it's processed according to the UPDATE rules. When a subdirectory is encountered, scan_drive() calls itself recursively to process that subdirectory. The scanning routine is represented in pseudocode in Figure 2.

As with all recursive algorithms, UPDATE places heavy demands on the stack. This is why, as was mentioned earlier, UPDATE was compiled with a stack size of 16,384 bytes. If you compile with the default stack size of 2,048 bytes, UPDATE may fail with a stack-overflow error when you use it to scan a large disk with a deep directory structure.

DOS SYSTEM CALLS UPDATE uses DOS system calls to manipulate files. The Microsoft C runtime library provides a whole family of functions that prepackage the DOS system calls, making it unnecessary for you to call the interrupt routines directly. These functions, most of which have names that start with _dos, include calls for file opening, file reading, file writing, and everything else the program needs. The new Borland compiler, Borland C++, Version 4.0, also provides a complete set of prepackaged DOS system calls. You cannot, however, compile UPDATE.C using the Borland compiler

without making some minor modifications to the source code, because Borland uses some different names for manifest constants and structures.

Why use DOS system calls for file access rather than the C runtime library's stream functions, such as fopen(), fclose(), fwrite, and fread()? The choice was dictated by the need to manipulate the time and date stamp of the copied files. When the program "copies" a file, it is actually creating a new file, and DOS automatically assigns the current time and date to the file. I felt it desirable for each copied file to have the same time and date as the more recent file. The only way to do this in C is with the _dos_setftime() function, which uses DOS system call interrupt 0x21, function 0x57 to set a file's time and date stamp. Because _dos_setftime() requires the handle of the file, it works only on files that have been opened with one of the DOS file-opening functions—_dos_creat(), _dos_creatnew(), or _dos_open()—and will not work with files opened with the standard C library stream functions, which do not provide access to a file's handle.

ERROR HANDLING Error handling in UPDATE has been designed to take into account that the program will often be run from a batch file. For user errors, such as

entering inappropriate command line arguments, the program will display an error message and terminate gracefully. For other problems, such as errors encountered in opening a file or allocating memory, the program terminates and returns an error code to the operating system indicating the nature of the error. The table below lists the return codes and their meanings. If you're running UP-

DATE from a batch file, you can use the ERRORLEVEL statement to detect the program's return value and take appropriate action.

```
1. Error opening a file
2. Error reading from a file
3. Error creating a file
4. Error writing to a file
```

If you work on two computers and regularly transfer data files between them, you'll find UPDATE a great convenience. One thing it won't do, however, is remind you to toss that disk into your briefcase! □

PETER G. AITKEN IS ON THE FACULTY AT DUKE UNIVERSITY MEDICAL CENTER AND HAS WRITTEN NUMEROUS ARTICLES AND BOOKS ON COMPUTER PROGRAMMING.

GUIDE TO OUR UTILITIES & HOW TO GET THEM

UPDATE

PURPOSE: UPDATE takes two file sources, such as a floppy disk and a hard disk subdirectory, and synchronizes them so both contain the latest version of your files. This makes it easier to move files between home and work computers.

FORMAT: UPDATE path1/drive path2/drive [options]

At least one of the path/drive parameters must be a path; both cannot be drives.

The option switches for UPDATE are

- /L Logs file-copy operations
- /Q Quick mode skips the verify step when a drive is used as a parameter and duplicate filenames are found

The return codes for UPDATE are

- 0—Normal program termination
- 1—Error opening a file
- 2—Error reading from a file
- 3—Error creating a file
- 4—Error writing to a file

REMARKS: UPDATE removes the tedium of transferring files between your work and home computer. It can be run unattended in a batch file. When you use a drive specification as a parameter in a batch file, you must include the /Q option to avoid being prompted for verification when duplicate filenames are encountered. This option should be used with extreme care, since you could potentially replace the wrong versions of files.

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THE FIRST TIME If you've never used ZiffNet, you'll need to find the access number nearest you. First, set your communications software to 7 data bits, even parity, no stop bits, and full duplex. Then dial 800-346-3247 with your modem. When the modem connects, press Enter. At the HOST NAME prompt, enter PHONES. Follow the menus and note the closest access number. Or dial 800-635-6225 (voice) and follow the instructions.

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PC Solutions

TIPS AND TECHNIQUES TO INCREASE YOUR PRODUCTIVITY

Hardware

KEEP IT COOL

❷ The cooling fan in the power supply of my 386-based machine has failed, and I've noticed the computer heating up. Is there any place I can get a reliable replacement fan, or do I have to replace the entire power supply?

*Yenching Wu
Fresno, California*

► **PC MAGAZINE:** Heat is the number one enemy of electronic components, and an adequate flow of air through your computer case is your first line of defense. While you can probably find a suitably sized, square-shaped muffin fan that would physically fit inside your power supply at an electronics outlet, such as Radio Shack, that's not the end of the story. Most people in your situation find it easier and safer simply to replace the power supply.

The first problem you face is that many power-supply housings are welded shut, so you can't open them to get at the fan. If you do have a unit that is bolted together, it would be a good idea to use a voltmeter to check that power is in fact reaching the fan before you actually remove the power supply.

In choosing a replacement fan, the primary factors you need to consider are the dimensions of the fan's mounting holes and housing, its voltage requirements, and its capacity rating in cubic feet per minute. If you have to substitute for any of these specifications, the only one that can vary is the capacity rating. Even then, make certain that the replacement equals or exceeds the rating of the original fan. The problem at this point is that you may have no way of determining just what that

original capacity was.

If a replacement power supply is starting to look like an attractive approach, remember that there are additional advantages to a new power supply besides easier installation. For one, you'll be getting a new component that will be backed by a warranty of some sort, which is not the case with just a new fan. A replacement power supply also gives you the opportunity to upgrade to a higher wattage rating—a good idea if you've loaded a lot of extras (such as memory, hard disks, tape drives, and expansion cards) into your system. Moreover, a new power supply gives you the chance to get one especially designed to be quiet. Many original power supplies sound like a 747 taxiing for takeoff.

When purchasing a new power supply, you must, of course, match its size and shape to those of your case. Before you take out the old one, be careful to label all the cables (and the orientation of their plugs) that run to the motherboard, the disk drives, and so forth. And whether you replace the entire supply or just the fan, you'll still want to deal with a reputable specialty company, such as PC Power & Cooling (619-723-9513).—*Alfred Poor*

A STICKY PROBLEM

✓ **TIP** In last summer's humidity, I had lots of problems printing envelopes on my laser printer. The envelopes would get sealed as they were printed. Then I discovered a little trick.

Place about ten envelopes in a microwave oven and cook them on high for 1 minute. Be sure to space the envelopes so that there is no pressure on the gummed edges, or they will seal. Remove the envelopes and let them cool for a few moments before printing on them.

*Lora Mazza
Greenwich, Connecticut*

► **PC MAGAZINE:** This is the first recipe received by Solutions, and it's a tasty solution to a sticky problem. The glue on the envelopes is hygroscopic (meaning that it attracts water), and in humid environments, the heat of the fusing rollers softens the moist glue enough to seal the envelopes before you put your letters in them. This is not a problem in the winter or inside air-conditioned offices where humidity levels are kept low.

You should resist the temptation simply to leave the envelope flap open as you

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See index, page 295.

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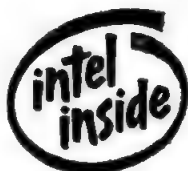
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feed it through the printer, since this can cause other problems. Many laser printers feed envelopes down the center of the paper path, and expect to have two parallel edges to guide it. And even if you can feed the envelope accurately with the flap open, you run the risk of picking up stray toner on the flap (making a messy envelope) or transferring glue to parts of the printer's paper path (creating the risk of a gummed-up printer.)

So "nuking" your envelopes makes sense. Microwaves create heat by causing water molecules to vibrate; when those molecules vibrate sufficiently, the moisture is boiled off. A preferable solution is to keep your envelopes dry in the first place. If you don't use envelopes often, consider buying smaller quantities. Store them in sealed containers and take out only as many as you need at a time.

There's one more important aspect to this topic. Many users realize the importance of using a good grade of paper for any type of printing in a laser printer. Few are aware, however, how much difference the moisture content of the paper can make. Too much moisture in the paper can result in problems with reliable paper feeding, excessive curling or wrin-

bling of the paper as it passes through the printer, and diminished toner adhesion.—*Alfred Poor*

Operating Environments

FIXING YOUR USER NAME IN WINDOWS

❓ How can I correct user information that was entered when Windows was installed on my PC? The store technician

who installed Windows for me misspelled my last name. Now whenever I select Help>About from the menu, I am reminded that I'm not who my computer thinks I am.

*Frank Johnson
New York, New York*

► **PC MAGAZINE:** The safest way to update the customer and company name is to get out your original Windows disks and go through a minimal reinstallation. Run SETUP, select Custom setup, and choose your existing Windows directory as the destination. Fill in your correct name and company name when prompted. When SETUP asks how much of Windows you want to install, check the box labeled "Set Up Only Windows Components You Select" and remove the checks from the other two boxes. The next screen lists five groups of files that you can choose to install—deselect all five. Now go ahead and finish the installation.

If the idea of reinstalling Windows makes you nervous, you can probably get the technician to help you without having to bring your computer back to the store. Ask the technician to perform a minimal Windows installation on a similar computer in the store, inserting your correct name and company name. Then copy the file USER.EXE from the System directory of the resulting installation to a floppy disk. On your own computer, switch to the System directory (usually C:\WINDOWS\SYSTEM) and rename USER.EXE to USER.SAV. Then copy USER.EXE from the floppy disk to this directory. You should now have a working Windows installation with your name

Our Advisors

Douglas Bolling is a contributing editor and the author of many utilities, including MBOOT.COM and EMS40.SYS.

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M. David Stone is a contributing editor and coauthor of *Word for Windows Companion*, Second Edition.

Ethan Winer is a contributing editor and the author of *PC Magazine BASIC Techniques and Utilities*.

HOW TO CONTACT US

Do you have a hardware, software, or systems problem you can't solve? Maybe you'd like a better understanding of how something works. If so, we invite your questions. Our experts can give you practical solutions to your problems, provide techniques for using your software and hardware more productively, and help you grasp computer concepts and understand the latest technology.

Do you have a solution to a problem or a tip you think other readers could use? For any tip we print, you'll receive \$50 plus a *PC Magazine* T-shirt. We regret that we cannot answer letters individually.

It's easy to contact us. Just send us your submission (use ASCII format for text files) via the medium that's most convenient for you:

U.S. Mail: Solutions, *PC Magazine*, One Park Ave., New York, NY 10016-5802. (Please send a floppy disk along with a printout.)

Fax: 212-503-5799.

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CompuServe Mail: 72241,104.

PC MagNet: Select Submissions to *PC Magazine* from the main PC MagNet menu. Upload your file to the most appropriate library. If at any time you need help, simply type a question mark (?) and hit Enter; a list of commands will be displayed. If you are not already a member of PC MagNet but would like to join, follow the instructions on page 12 to find your local access number.

CompuServe Members: If you're a CompuServe member, you can join PC MagNet by typing GO PCMAG at any CIS prompt.

Operating Environments

entered correctly. If for any reason Windows doesn't load properly, delete USER.EXE and rename USER.SAV back to USER.EXE.

It is also possible to use DEBUG or a byte-level file editor to locate the incorrect name in the file USER.EXE and change it. But it's easier, however, just to spend a little time reinstalling Windows.

—Neil J. Rubenking

GETTING RID OF ODDLY NAMED FILES

☛ Somehow I've ended up with files and directories on my hard disk that I cannot get rid of. The files and directories in question have names such as WPC K, A&L L L, ZI, CO, _Σ1. The problem is I can neither delete them nor rename them. Do you know of any way to get rid of files and directories if they're not recognized by DOS?

Gene B. Bodel
San Francisco, California

► **PC MAGAZINE:** The only problem with the names WPC K and A&L L L is that they contain spaces. Internally, DOS allows filenames with spaces, but at the command line, DOS treats a space as a separator. If you try a command like DEL WPC K, DOS sees it as DEL WPC plus a superfluous parameter K. Fortunately, there are ways to rename or delete such files.

First, enter DIR followed by the filename, replacing any spaces with question marks (for example, DIR WPC?K). If DIR lists any files besides the problem file, temporarily move them into another directory. Now you can rename the file to change the space into an underscore (for example, REN WPC?K WPC_K). If you prefer, just delete the file with the command DEL WPC?K. You could do the same with files containing other strange characters, such as the Σ character in the name _Σ1. The names ZI and CO from your list appear to be perfectly valid—perhaps they have spaces at the beginning or end of the name.

If you're running DOS 6.x, you can

rename a problem directory in the same way, using the MOVE command. Again, start by entering DIR followed by the directory name, replacing any spaces with question marks (for example, DIR A&L?L?L). Move or rename any other matching files. Now use MOVE to change spaces to underscores (for example, MOVE A&L?L?L A&L_L_L).

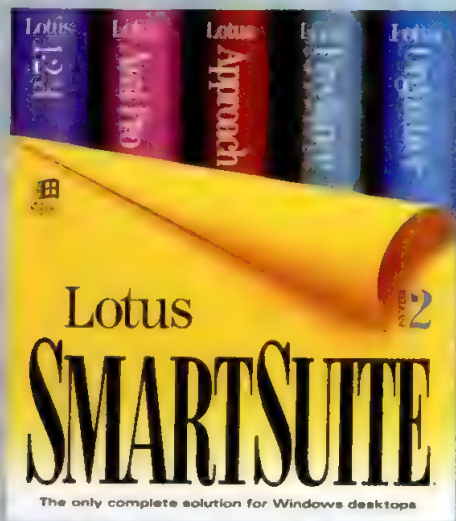
In DOS 5.0 or higher, you can take advantage of QBasic's Immediate window to work directly with filenames and directory names containing spaces. Load QBasic and click on the Immediate window at the bottom of the screen, or press the F6 key until the window title Immediate is highlighted. Now you can use the QBasic command KILL to delete a file, RMDIR to delete a directory, or NAME to rename either a file or a directory. All you have to do is put the name in quotation marks (for example, KILL "WPC K", RMDIR "A&L L L", or NAME "WPC_K" AS "WPC_K"). This is probably the easiest way to deal with files and directories whose names contain spaces!

—Neil J. Rubenking

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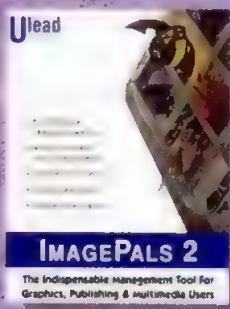
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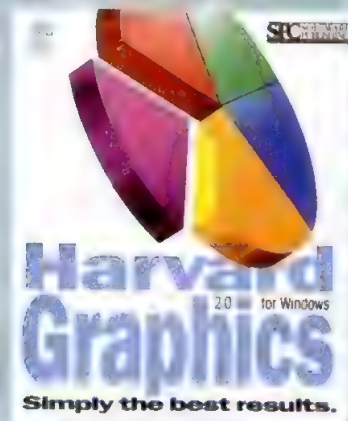
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SHOWPATH.BAT

Complete Listing

```
@ECHO OFF
CLS
ECHO The current command PATH directories are
FOR %%p IN (%path%) DO ECHO %%p
```

Figure 1: This batch file attempts to list the directories in the path but fails if the path is longer than 104 characters.

SP.BAT

Complete Listing

```
@ECHO OFF
REM SP.BAT - displays the directories in the path
REM each on its own line
IF NOT '%1'=='' GOTO ListThem
CLS
ECHO The current command PATH directories are
%0 %path%

:ListThem
ECHO %1
SHIFT
IF NOT '%1'=='' GOTO ListThem
```

Figure 2: SP.BAT successfully lists the directories in the path by working with the 127-character limit on DOS commands.

DISPLAYING A LONG PATH

❷ SHOWPATH.BAT, listed in Figure 1, types a heading, then shows the directories in the current path down the left side of the screen. My original path included 16 entries, and SHOWPATH ran without problems. Then I added two more directories to my path, and now I get "Syntax error" when I run the batch file. When I type PATH without parameters, the actual path shows correctly.

The 18 entries in my current path total 115 characters (including semicolons). The SHELL= line in my CONFIG.SYS file specifies an environment size of 1,024 bytes, and my whole environment takes up only 396 bytes. The directories on the path are all valid. So what's the problem?

*William F. Myles
Grand Rapids, Michigan*

► **PC MAGAZINE:** You're not running out of environment space—you're running past the end of the DOS command line! This is the problem line in SHOWPATH.BAT:

```
FOR %%p IN (%path%) DO ECHO %%p
```

A DOS command, whether typed at the command line or included in a batch file,

is limited to a total of 127 characters. This limitation applies *after* all parameters and environment variables have been replaced by their values and after any double percent signs have been replaced by single percent signs. The line in question contains 23 characters plus the value of the path environment variable. If the path is longer than 104 characters, the line will be longer than the 127 character limit. Your original path contained fewer than 104 characters, but when it expanded to 115 characters, the batch file failed.

The longest possible path is 122 characters—that's the 127 character limit minus the 5 characters in PATH=. Figure 2 shows SP.BAT, a batch file that lists the directories in the path even at this maximum length. When you type SP at the command line with no command line parameters, the initial IF test does *not* jump to the label ListThem. The batch file clears the screen and displays its header line, just like SHOWPATH.BAT. The next line is the important one. The %0 is replaced by the name of the batch file, and %path% by the current path. Since the batch filename is two characters long, this line will never be longer than 125 characters after expansion. Note that you must not rename

SP.BAT to anything with a name longer than four characters.

The line %0 %path% reexecutes SP.BAT, passing the entire path on the command line. This time there is something on the command line, and the initial IF test jumps to the label ListThem. DOS treats the semicolon as a separator for command line parameters, so each directory on the path becomes a separate parameter. The batch lines at the label ListThem simply echo each parameter in turn.—Neil J. Rubenking

ASSIGNING ONE VARIABLE TO ANOTHER IN WP 5.1

✓ **TIP** The WordPerfect 5.1 macro command {TEXT} accepts user input and assigns it to a variable. If the input is a range of numbers separated by a hyphen—such as 1-23—the input is assigned to the variable as a text string, as you'd expect. If you then use the {ASSIGN} command to assign the first variable to a second variable, however, WordPerfect treats the entry as a mathematical formula and calculates the result.

To see how this works, you can try the following macro:

```
{TEXT}Page~Enter a range of
page numbers: ~
{ASSIGN}Entry~{VARIABLE}Page~
Variable "Page" is: "{VARIABLE}"
Page~
Variable "Entry" is: "{VARIABLE}"
Entry~
```

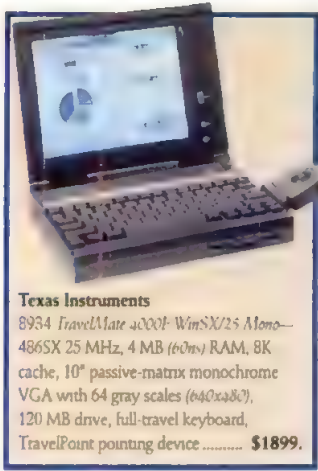
This causes a message to appear on the bottom line of the screen asking you to enter a range of page numbers. The range you enter is stored as the variable *Page*. The macro then assigns the contents of *Page* to the variable *Entry* and puts the last two lines in your document, using the values of *Page* and *Entry*.

If you enter the range 1-23, for example, the lines reported will read

```
Variable "Page" is: "1-23"
Variable "Entry" is: "-22"
```




Texas Instruments
6441 TravelMate 4000F WinDX/50
Active Matrix Color Notebook—
6.3 pounds, 200 MB, 16ms IDE
Hard Drive, 8.4" Active Matrix
Color Display, 4 MB RAM
(upgradable to 20 MB), 1.44 MB
Floppy, Trackball **\$3799.**



Texas Instruments
8934 TravelMate 4000F WinSX/25 Mono—
486SX 25 MHz, 4 MB (60ms) RAM, 8K
cache, 10" passive-matrix monochrome
VGA with 64 gray scales (640x480),
120 MB drive, full-travel keyboard,
TravelPoint pointing device **\$1899.**



Texas Instruments
14288 TravelMate 4000F WinDX/50
DualScan Color Notebook—50MHz 486DX2
with coprocessor, 8K cache, 4 MB RAM,
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9984	ProLinea 4/33S, 240 MB, Win.....	1249
10894	ProLinea 4/50, 240 MB, Win., PFS WindowWorks, faxmodem.....	1759
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11417	Contura 4/25C w/209 MB, Win.	2879
11646	DESKPRO 4/66M w/510 MB, Win.	3599
2016	LTE Lite 4/25 w/120 MB, Windows	2049
3029	LTE Lite 4/25E w/209 MB, Win.	3099

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12590	Ready 425CD2 Multimedia System, 170 MB, Windows.....	1499
13347	Ready 425es, 170 MB, Win.....	999
13346	Ready 433es, 210 MB, Win.....	1229
13345	Ready 466es, 250 MB, Win.....	1729

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14355	T4700CS Passive Color w/320 MB	4329

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TurboTax/Quicken DOS or Win. ea.		54 95
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6022	ClarisWorks/Quicken (while supp. last)	95 95
5257	FileMaker Pro Windows.....	119 95
5228	FileMaker Pro Win Comp. Upgrd.	95 95
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2682	The FarSide Daily Planner.....	39
Inuit Quicken for DOS or Windows ea....		39 95
Lotus		
5982	SmartSuite 469 95 11771 Upg.	299 95
2756	1-2-3 4.0 - Win. (2755 5 1/2").....	309 95
3428	1-2-3 4.0 - Win. Upg. (3424 5 1/2")	99 95
13578	Ami Pro w/Quicken Bundle.....	269 95
13577	Ami Pro w/Quicken Comp. Upgdl.	119 95
5005	Freelance Graphics 2.0 (3523 5 1/2")	349 95
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12714	PharmAssist Windows.....	39.95
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Notebook Computer—6 pounds, 120 MB HD,
6.2" Advanced Passive Color Display, 4 MB
RAM (upgradable to 30 MB), 1.44 MB Floppy,
Ballpoint Mouse w/QuickPort,
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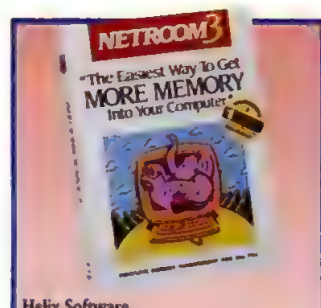
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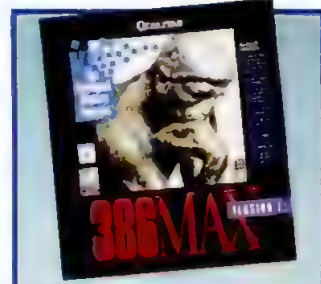
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10868 WinSense 2.0—Fine tune your own Windows 3.1 environment easily and logically. WinSense develops a user profile to maximize your Windows performance. Includes FREE Disk Optimizer for Windows (while supplies last)..... **\$56.95**



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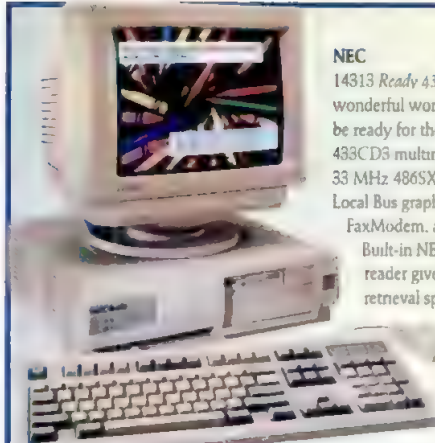


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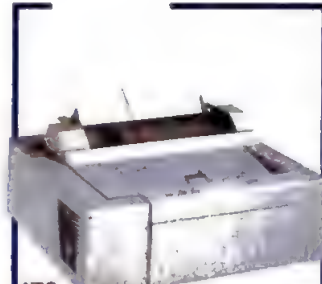
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Note that WordPerfect also recognizes other mathematical operators when you use this trick.

*William J. Wolfe
Champaign, Illinois*

► **PC MAGAZINE:** Mr. Wolfe's tip should perhaps best be taken as a warning to be careful when you assign one variable to another. Since there may be circumstances when you might want to take advantage of this quirk, however, it's worth exploring the macro's calculation capability a bit.

You can build a simple (but very limited) calculator by changing the macro to read

```
{TEXT}Formula~Enter a formula to
calculate: ~
{ASSIGN}Result~{VARIABLE}Formula~
{VARIABLE}Formula~ = {VARIABLE}
Result~
```

The only differences between this version and the example given by Mr. Wolfe are in the text and the variable names. If you enter 2 + 2 in response to the first line, the macro will put 2 + 2 = 4 in your document.

Unfortunately, the arithmetic calculations are limited to integers. If you enter 1.1 + 1, the second variable will also read 1.1 + 1. Furthermore, when dividing, the result throws away everything to the right of the decimal point. For example, 99/20 comes out as 4. Again, there is no easy way to make the macro deal with nonintegers properly. (It is possible but not easy to build a macro that will handle nonintegers. To see what's involved, look at CALC.WPM, the calculator macro that comes with WordPerfect.)

As always with WordPerfect 5.1 macros, to enter any command that shows in all uppercase in the macro editor, press Ctrl-PgUp and pick the command from the pop-up list.

Finally, you should note that in WordPerfect 6.0, if you use the ASSIGN command to assign one variable to a second variable, WordPerfect does *not* treat the entry as a mathematical formula. If the first variable is 1-23, the second will also be 1-23. I'll take up the creation of WordPerfect 6.0 calculation macros on another occasion.—*M. David Stone*

Spreadsheets

MISSING LOTUS FEATURE?

❓ I want to be able to switch between my printer on LPT1 and Delrina WinFax on COM2 in Lotus 1-2-3 for Windows, Release 4. I can access the File Printer Setup dialog box with {DIALOG? "Printer-Setup"}, but the {Down} and {Up} commands won't move the highlight pointer in the dialog box. Is there a macro I could use?

*Robert W. Anderson
via CompuServe*

► **PC MAGAZINE:** Regrettably, 1-2-3's macro language does not provide any means for passing keystrokes to dialog boxes. As you've found, you can get to

For many common dialog-box operations, Lotus does provide menu-equivalent macro commands.

the Printer Setup dialog box, but you can't change the setup once you're there. Your macro simply pauses after executing the {Dialog?} command and resumes when you dismiss the dialog box.

For many common dialog-box operations, Lotus does provide menu-equivalent macro commands that accept arguments. You could use the command {File-Retrieve "mynums.wk4"} to retrieve MYNUMS.WK4, for example. As yet, however, there is no menu-equivalent command for Printer Setup. A Lotus spokesperson says this item is at the top of the company's list of macro enhancements scheduled for the next version.

—*Craig Stinson*

JUSTIFYING COLUMN HEADINGS

❓ In Lotus 1-2-3, Version 3.1, I frequently want to use a function or formula to create a label that will be used as a column heading. Since the heading will

appear over a column of numbers, it will look best if it's right-justified.

If I were creating the label at the keyboard, preceding it with the double-quote character would right-justify it. But if the label is the result of an @LEFT or @MID function (or even of plain old "+A1", where A1 is a label), I can't get it to right-justify. The /Range Label Right command doesn't seem to affect labels produced by formulas or functions.

I have the same problem when I want to left-justify numbers in date format. Is there any way to get these labels to line up the way I want them?

*Kenneth R. Bailleu
Deerfield, Illinois*

► **PC MAGAZINE:** You're right: There is no way to right-align the result of a Lotus 1-2-3 string formula. If you don't need to maintain a live link between your text formula and some other cell, however, you can solve your problem simply by converting the string created by the formula back into an ordinary label and then right-aligning the label.

For example, suppose that cell A1 contains the formula

```
+ "> "&@STRING(H1,0)&" days"
```

and this formula produces the following text string:

```
>60 days
```

To convert A1's contents into a right-aligned label, select A1, use the /Range Values command, and press Enter twice. Then press F2, press Home, delete the apostrophe, and enter a double quotation mark. The whole process, of course, could be encapsulated into the following macro:

```
\a /RV~
{Edit}{Home}{Del}~
```

Getting left-aligned dates is a little more difficult. By using the @STRING function, you can convert an ordinary number into a text formula, which—like all other text formulas in 1-2-3—will be left-aligned. But @STRING doesn't work with date values. Your best bet is simply to type the date as a text string.



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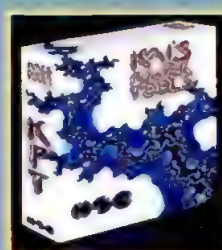
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Note that if you do this and create a label that looks just like one of 1-2-3's standard date formats, you can still perform date arithmetic on it by using the @DATEVALUE function. @DATEVALUE returns the serial date value for the date, expressed in a string.

Suppose, for example, that cells A1 and A2 contain the labels '14-DEC-93 and '16-NOV-94. In this case, @DATEVALUE(A1) and @DATEVALUE(A2) will return 34317 and 34654, respectively, and you could use @DATEVALUE(A2)-@DATEVALUE(A1) to calculate the number of days between the two dates.—Craig Stinson

Databases

CLEARING THE DEBUG WINDOW

TIP Here's a useful tip that many people are not aware of. You can remove all expressions and breakpoints from FoxPro's Debug window and close the window by simply bringing the Debug window to the top and then typing Ctrl-End.

Barry Chertov
via CompuServe

► **PC MAGAZINE:** This is indeed quite useful and is apparently undocumented. The Debug window saves your entries when you close it, so they automatically reappear the next time you open that window. Removing the entries normally requires a tedious process of selecting and deleting each entry individually. If you want to clear *all* of the entries, however, Mr. Chertov's discovery can eliminate this process.—Sal Ricciardi

FAST EXIT FROM PARADOX

TIP When you exit or cancel an edit in Paradox, you automatically get a secondary confirmation prompt. You can eliminate the occasionally annoying extra keystrokes required by this prompt by creating a couple of simple scripts that you tell Paradox to run automatically every time it starts up.

On my system, for example, I've as-

signed Ctrl-F9 as my CANCEL key and Ctrl-F10 as my EXIT key. The CANCEL.SC script is the single line

```
Menu {Cancel} {Yes}
```

The EXIT script, EXIT.SC, is similar:

```
Menu {Exit} {Yes}
```

To bind these scripts to the keystrokes, just put the following two lines into your INIT.SC file, which will play automatically whenever Paradox starts:

```
Setkey -103 PLAY "EXIT"  
Setkey -102 PLAY "CANCEL"
```

I keep the script files in the PDOX45 Paradox system-files directory, but if you're on a network, you should place them in the PRIVATE directory.

Baldwin Leong
via CompuServe

*AT&T was the only
manufacturer that could
sell the first modems that
connected directly to the
phone lines.*

► **PC MAGAZINE:** This confirmation prompt can be very valuable in preventing accidental data loss if you pause and think about just what you're doing, as a beginner should. Once familiarity has bred confidence, however, the extra keystrokes can sometimes be annoying.

Both of Mr. Leong's scripts make use of Paradox's ability to use the Menu command in a script to execute menu choices. For example, the EXIT script selects the Exit menu and chooses Yes. Once you bind this script to a keystroke with the Setkey command, exiting Paradox requires just one keystroke instead of three (F10, Exit, Yes).

You can attach scripts to any of Paradox's supported key codes, all of which are listed in appendix G of the PAL (Paradox Application Language) reference.—Sal Ricciardi

Communications

MODEM PROTOCOLS

❓ I was thinking about buying a modem but really didn't know anything about them, so I looked through my *PC Magazine* back issues and found a feature story on 14,400-bps modems. As I read the story, though, I became even more confused. What do V.32, V.32bis, and V.42 mean? Which should I look for, and what are the differences?

Glenn R. Ramsey, Jr.
Roanoke, Virginia

► **PC MAGAZINE** You're not the only one who's confused; we get a number of letters asking similar questions. The letter and number combinations you're asking about are different standards for modem communications that ensure that modems made by different manufacturers can talk to each other. When the first modems that connected directly to the phone lines were created, AT&T was the only manufacturer that could sell them in the United States. At the time, laws and government regulations restricted the use of third-party devices on AT&T's telephone network, so AT&T had a virtual monopoly on the market and set the standards for modem communications.

Modems communicate by converting the digital 0s and 1s that computers use into audio tones that alternate between two different frequencies. The use of alternating tones is called the data modulation method (in fact, the word modem is short for modulator/demodulator). In order for two modems to talk to each other, the modems have to use the same modulation scheme. AT&T established two modulation standards: the Bell 103 standard for 300 bps and the Bell 212A standard for 1,200 bps. You'll still see references to them in modem manuals.

In the late 1970s, the laws restricting the use of third-party devices on the phone network were lifted, opening the way for a number of vendors to enter the modem market. Initially, the vendors followed the AT&T standards to ensure that their products were compatible with existing modems. AT&T's influence over the market decreased, however, as both

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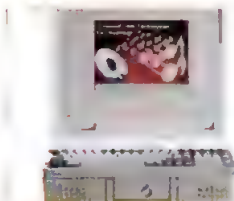
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ULTRA16 ETHERNET COMBO	125.35
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ETHERCARD+ ELITE MCA COAX	189.26
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ETHERCARD+ ELITE MCA 10BT	189.55
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intel

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ETHEREXPRESS 16 10BT	99.33
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ETHEREXPRESS MCA 10BT	166.52
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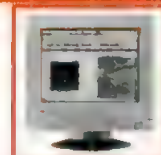
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Data Protocol	V.22bis	V.22bis	V.32	V.32	V.22bis	V.22bis	V.22bis	V.22bis
Send Fax bps	14.4K	14.4K	9600	14.4K	9600	9600	9600	9600
Receive Fax bps	14.4K	14.4K	9600	9600	9600	9600	9600	4800
Error Correction (V.42, MNP 1-4)	✓	✓	✓	✓	✓	✓	✓	
Data Compression (V.42bis, MNP 5)	✓	✓	✓	✓	✓	✓	✓	
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the number of vendors entering the market and modem speeds increased; a new system of standards was needed.

The task of setting international modem standards fell to the CCITT, which is part of the International Telecommunication Union (ITU). In cooperation with modem manufacturers, the CCITT now sets the standards for modems, using the V.x numbering system. The Bell 103 standard became V.21, and the Bell 212A standard became V.22. Other modulation standards are

- V.22bis: 2,400 bps.
- V.32: 9,600 bps.
- V.32bis: 14,400 bps.

The CCITT is currently developing the standards for 28,800-bps modems, under the working name V.FAST. Note that these standards are backward-compatible, so a V.32bis modem can talk to a V.32 or V.22bis modem with no problems, though at the slower speed.

In the early 1980s, Microcom introduced a number of modem protocols that provide for error control and data compression during modem communications. Microcom called these protocols MNP (Microcom Networking Protocol) and assigned them different classes; Microcom also made the early versions freely available to other modem vendors. Today you'll still see references to MNP Class 4, which governs error control, and MNP Class 5, which governs data compression.

Once again, the CCITT stepped in and set international standards for these capabilities. Unfortunately, they used the V.x system to identify them, leading to some confusion among modem users. The CCITT standards are

- V.42: error control based on the LAP-M protocol developed by Hayes.
- V.42bis: data compression.

The MNP Class 4 and 5 protocols are also supported by the CCITT as the alternative protocols to the previous two.

Error-control protocols are sometimes improperly referred to as error-correction protocols. An error-control protocol doesn't fix errors that have entered the data transmission; what it does do is monitor the data flow and lets the sending modem know that the receiving modem received erroneous data. The sending modem can then retransmit the

data until the receiving modem acknowledges that it got the data correctly. This is why modem users occasionally see their data throughput decrease over marginal phone connections.

To increase throughput, data-compression protocols compress the data before it's sent. These protocols are mostly useful for text transfers, as most modem users precompress their data with one of the file archiving utilities available today. The MNP Class 5 protocol doesn't distinguish precompressed data from uncompressed data, so that protocol could cause a decrease in throughput during transfers of file archives. The V.42bis protocol is better, because it has some built-in intelligence to recognize compressed data and doesn't attempt to recompress it during transmission.

When you're buying a new modem, you want to make sure it follows the CCITT standards (virtually all modems made today do). If you're looking for a 9,600 bps modem, you want one that supports the V.32 protocol. For 14,400 bps, you want a V.32bis modem. In either case, you should get a modem that supports the V.42 error control and V.42bis data-compression protocols as well as the MNP Class 4 and Class 5 alternatives.

—Joe Salemi

▶ Languages

GETTING THE VERSION AND MODE OF WINDOWS

❓ How can a C program ascertain which version of Windows is being run when the program is called in a DOS window? Also, how can I establish whether Windows is running in Real, Standard, or Enhanced mode?

P.C. Whitaker

The Peak, Hong Kong

▶ **PC MAGAZINE:** The techniques necessary for a DOS program to determine what version and mode Windows is running are interrelated. Unfortunately, like everything else under DOS, the techniques involve calling interrupt-based functions, particularly functions using the multiplex interrupt (interrupt 2F

hex), which isn't always convenient in high-level languages.

The process of determining the Windows version is rather involved, since before Windows 3.1 there was no single function a DOS program could call that returned the mode and version of Windows. Before I explain the accompanying program, which performs the necessary tasks, I'll discuss the method itself. Essentially, it involves checking for Windows 3.1. Then if Windows 3.1 isn't running, you need to call a series of functions that, by elimination, narrow the possibilities down until you've determined the version and operating mode of Windows.

Here are the specific steps: First, try calling Windows 3.1's Identify Windows Version function by invoking the multiplex interrupt with AX equal to 160A hex. If the function returns with AX equal to 0, the Windows major version will be in BH and the minor version will be in BL. For Windows 3.1, BX returns with 30Ah. The function returns the operating mode in CX. If you're running in Enhanced mode, CX contains 3; otherwise, CX contains 2, indicating Standard mode. (Note that Microsoft discontinued Real mode in Version 3.1 of Windows.)

Since the Identify Windows Version function is supported in only Windows 3.1 and later, if the function returns with AX a nonzero, you know you're not running under Windows 3.1. Next, try calling the Detect Enhanced Mode Windows function, using the multiplex interrupt with AX equal to 1600h. Here, things get a bit tricky. If the function returns with AX unchanged, Windows is not running in Enhanced mode. If AL returns with 0FFh or 080h, Windows/386 is running. Otherwise, AX contains the major and minor version numbers of Windows 3.0, and it is running in Enhanced mode.

If the Detect Enhanced Mode Windows function fails, try calling the Detect Real and Standard Mode Windows function by using the multiplex interrupt with AX equal to 4680h. If this function returns with AX nonzero, Windows is not running. If AX is 0, we still cannot assume that Windows is running, since the DOS Task Switcher may be running instead.

To check for the Task Switcher, call the multiplex interrupt with AX equal to

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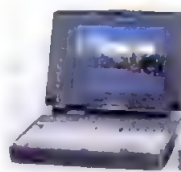
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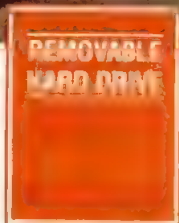
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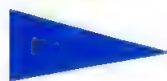
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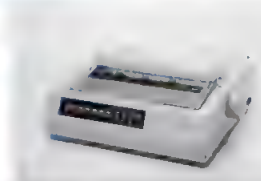
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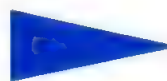
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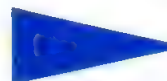
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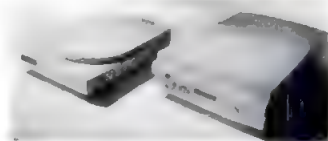
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WINVER.C

Complete Listing

```
//
// WinVer - A DOS program that displays the version and operating mode
// of Windows.
//
// Copyright 1994 Douglas Boling
//
#include <stdio.h>
#include <stdlib.h>
#include <dos.h>

int GetWinEnv (int *, int *);

char *szModeText [3] = {"Real", "Standard", "Enhanced"};
char *szCopyright = "\nWinVer 1.0 Copyright 1994 Douglas Boling\n\n";

int main () {
    char szTemp[34];
    int WV, WM;

    printf (szCopyright);

    if (GetWinEnv (&WV, &WM))
        printf ("Windows not running\n");
    else {
        printf ("Windows version ");
        itoa (WV >> 8, szTemp, 10);
        printf (szTemp);
        printf (" ");
        itoa (WV & 0x0ff, szTemp, 10);
        printf (szTemp);

        printf (" running in ");
        printf (szModeText[WM-1]);
        printf (" mode.\n");
    }
    return 0;
}

int GetWinEnv (int *psWinVer, int *psWinMode) {
    union REGS regs;
    struct SREGS sregs;

    //
    // Call Multiplex 160A to see if Windows 3.1 running
    //
    regs.x.ax = 0x160A;
    int86 (0x2f, &regs, &regs);
    if (regs.x.ax == 0) {
        *psWinVer = regs.x.bx;
        *psWinMode = regs.x.cx;
        return 0;
    }
    //
    // Call Multiplex 1600 to see if Windows enhanced mode running
    //
    regs.x.ax = 0x1600;
    int86 (0x2f, &regs, &regs);
    if (regs.h.al == 0) {
        if ((regs.h.al == 0xff) || (regs.h.al == 0x80))
            *psWinVer = 0x20A;
        else
            *psWinVer = (regs.h.al << 8) | regs.h.ah;

        *psWinMode = 3;
        return 0;
    }
    //
    // Call Multiplex 4680 to see if Windows standard or real mode
    //
    regs.x.ax = 0x4680;
    int86 (0x2f, &regs, &regs);
    //
    // If no response, not running under Windows.
    //
    if (regs.h.al != 0) {
        *psWinVer = 0;
        *psWinMode = 0;
        return 1;
    }
    //
    // See if DOS task switcher, if so, not Windows
    //
    regs.x.ax = 0x4b02;
    regs.x.bx = 0;
    regs.x.di = 0;
    sregs.es = 0;
    int86x (0x2f, &regs, &regs, &sregs);
    if (regs.h.al == 0)
        return 1;
    *psWinVer = 0x300;
    *psWinMode = 1;
    //
    // Simulate start of protected mode Windows. If rejected, assume
    // that Std mode Windows running.
    //
    regs.x.ax = 0x1605;
    int86 (0x2f, &regs, &regs);
    if (regs.x.cx == 0xffff)
        (*psWinMode)++;
    //
    // Call Terminate Win to fix any programs that count init/term
    // Windows calls.
    //
    regs.x.ax = 0x1606;
    int86 (0x2f, &regs, &regs);

    return 0;
}
```



Figure 3: This C program determines whether you're in Windows, and if you are, which version and mode are running.

4B02h, DI equal to 0, and ES equal to 0. If the function returns with AX equal to 0, the Task Switcher is running. If the Task Switcher is not running, we can assume that Windows 3.0 is running under either Standard or Real mode.

The final task is to differentiate between Windows 3.0 running in Real and Standard modes. To do this, we send out a notification to all resident programs that Windows is about to start, once again using the multiplex interrupt. If Windows is running in Standard mode, it will respond to the Windows Initialization call by indicating that Windows should not be started. Real-mode Windows, on the other hand, allows additional copies of Real-mode Windows to run inside a Windows DOS box. (This "feature" was fixed in Windows 3.1, since it was confusing to users to have multiple copies of Windows running at the same time.) To

simulate a Windows Initialization call, load AX with 1605h, clear CX, and then call the multiplex interrupt. If the call returns with CX loaded with 0FFFF hex, some program has indicated that Windows should not start. We can then assume that the program inhibiting Windows from running is Windows 3.0 itself running in Standard mode. If the notification returns with CX equal to 0, Windows is running in Real mode.

Finally, a program should call the Windows Termination notice in case some installed program is counting the number of initialization and termination notices. Calling the termination notice balances the call to initialization.

All this shows how a simple job has become convoluted, because of the Windows designers' lack of planning. A C routine that performs the steps above is shown in Figure 3. The code uses the INT

86 and INT 86x functions to perform the necessary multiplex interrupts. You can download WINVER from PC MagNet's Programming Forum.

The INT 86 function is called with pointers to two structures. The first contains the values that the various registers should be loaded with on the call. The second structure is loaded with the register values when the interrupt returns. For our purposes, the pointers point to the same structure that contains the necessary values on the call and is loaded with the results on the return.

The routine, called GetWinVer, is called with pointers to two integers. If the function detects that Windows is running, it returns a 0 return code, and the version and operating mode are loaded into the variables pointed to by the pointers. The function returns 1 if Windows is not detected.—*Douglas Boling*

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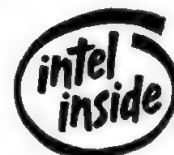
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- 16MB System RAM
- 2X CD-ROM
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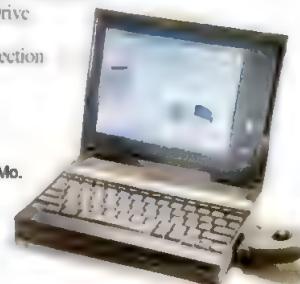
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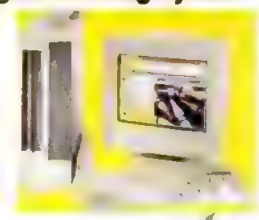
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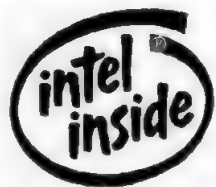
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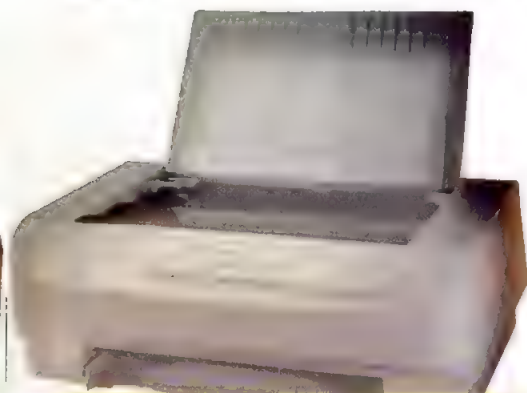
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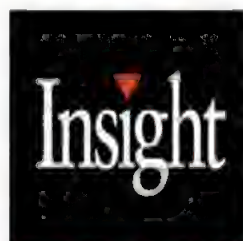
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170MB	12ms	2.5"	Western Digital	IDE	WDAL2170.....	319

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245MB	15ms	3.5" 1"H	Maxtor	IDE/SCSI	MX7245A/S.....	219/249
250MB	12ms	3.5" 1"H	Western Digital	IDE	WD2250A.....	219
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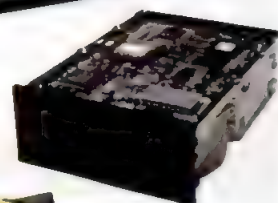
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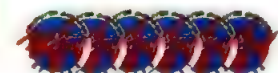


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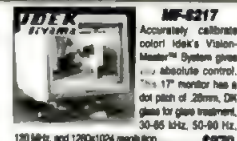
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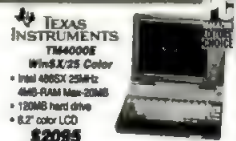
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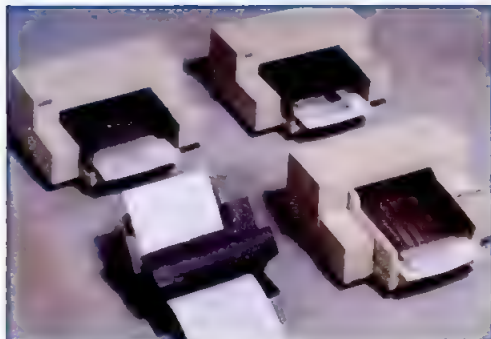
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IBM PS/ValuePoint Specifications

Model	Clock Speed	Hard Drive/ Ave. Access	ISA Slots	3.5"/5.25" Bays	Video RAM	DOS Version	Flex Part #	Flex Price* without monitor	Flex Price* with monitor
PS/ValuePoint SI - SpaceSaver									
486SX	25 MHz	120 MB/15 ms	3	2/1	512K	6.1	6381F30	Call	*1149
486SX	25 MHz	212 MB/13 ms	3	2/1	512K	6.1	6381F50	Call	*1249
486DX	33 MHz	120 MB/15 ms	3	2/1	512K	6.1	6381M30	Call	*1499
486DX	33 MHz	212 MB/13 ms	3	2/1	512K	6.1	6381M50	Call	*1629
486DX2	66 MHz	212 MB/13 ms	3	2/1	512K	6.1	6381W50	Call	*1999
PS/ValuePoint Desktop (Includes 32-Bit VLB Slot, ZIFF socket, and is Pentium™ Overdrive Upgradeable)									
486SX	33 MHz	170 MB/14 ms	5	3/2	1 MB	6.1	6384L40	Call	*1599
486DX	33 MHz	212 MB/13 ms	5	3/2	1 MB	6.1	6384N50	Call	*1799
486DX	33 MHz	340 MB/14 ms	5	3/2	1 MB	6.1	6384N70	Call	*1999
486DX2	66 MHz	340 MB/14 ms	5	3/2	1 MB	6.1	6384X70	Call	*2399

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- 4MB RAM (Upgradeable to 64 MB)
- VESA Local Bus SVGA video
- One 3.5", 1.44MB diskette drive
- 2 serial, 1 parallel, keyboard, mouse
- Basic 101-key keyboard
- IBM DOS and MS Windows 3.1
- 1 Year Onsite Warranty
- Around-the-clock IBM HelpWare Support



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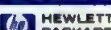
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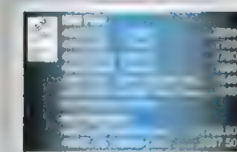
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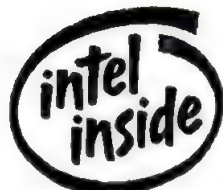


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Processor:

Intel 486SX-25, 486DX-33,
486DX2-50 or 486DX2-66
SL-Enhanced upgradeable processor

RAM:

4 Mb, expands to 20 Mb

Hard Drive:

120 Mb, 200 Mb, 340 Mb
or 520 Mb

Screen:

10" on Mono or Active units
10.3" on Dual Scan units
Backlit display
Color - 256 colors
Monochrome - 64 gray shades

Battery Life*:

Active Color - 3 hours
Dual-Scan Color - 4 hours
Monochrome - 6 hours

Weight:

Color - 6.9 lbs.
Monochrome - 6.4 lbs.

**512K DRAM with turbo bus
accelerated video technology**

**Simultaneous video on
active-matrix color and
monochrome units**

**86 keys with 101-key emulation
Built-in trackball**

Built-in 1.44 Mb, 3.5" floppy drive

Advanced Power Management

One parallel and one serial port

**External VGA and keyboard
connectors**

**One PCMCIA Type III slot/ two
Type II slots**

FREE AC adapter and utilities disk

FREE MS-DOS 6.2 installed

FREE carrying case

Call for additional configurations and ask about our new second year extended warranty on all Notebooks and SubNotebooks.

Elite 486SX-25 SubNote

Ancient Egypt is known for great myths, historical treasures and powerful dynasties. You can discover another source of great power with Elite's 486SX-25 SubNote.

The 486SX-25 has the latest features, like Intel's "SL-Enhanced" processor, Advanced Power Management and PCMCIA technology.

It's a mystery how a little 3.9 lb. SubNote contains as much power as a desktop, but it does. The 486SX-25 comes with 4 Mb of RAM, expandable to 12 Mb, a fast 25 MHz processing speed and your choice of a 120, 200 or 340 Mb hard drive. It also delivers excellent 640 x 480 VGA resolution on its 10" high-contrast screen producing clear, concise images that even a mummy can easily see!

Elite's unforgettable SubNote symbolizes power, ground-breaking technology and true portability. Before you hop on your camel to start your next historical journey—call Midwest Micro and order the 486SX-25.

Treasures:

Processor:

Intel 486SX SL-Enhanced processor

Processing Speed:

25 MHz

RAM:

4 Mb expands, to 12 Mb

Hard Drive:

120 Mb, 200 Mb or 340 Mb

Screen:

10", 640 x 480 VGA resolution
Backlit display
64 gray shades

Battery Life*:

5 hours

Weight:

3.9 lbs.

512K DRAM with turbo bus
accelerated video technology
Simultaneous video

83 keys with 101-key emulation

Built-in trackball

External 1.44 Mb, 3.5" floppy drive

Advanced Power Management

Nickel metal hydride battery

One parallel and one serial port

External VGA and keyboard connectors

One PCMCIA Type II slot

FREE AC adapter and utilities disk

FREE MS-DOS 6.2 installed

FREE carrying case



486SX-25 SubNote

120 Mb #005576 \$1399

200 Mb #005577 \$1479

340 Mb #005578 \$1579

Elite 486SLC2-50 Color/Monochrome Notebook

Discover the riches of the land with your Elite 486SLC2-50 Notebook. This portable is perfect for long journeys due to its compact size and energy-saving SUSPEND/ RESUME feature. You can even compute up to six hours on a single charge!

Available in color or monochrome, the Elite comes with a fast 50 MHz processor, internal cache memory and up to 8 Mb of RAM—giving you more power for your money!

Both 486SLC2-50 models have a record of unparalleled success in eliminating distortion and eyestrain with their non-glare VGA screens. Images appear at up to 640 x 480 resolutions in 64 gray shades or 256 colors revealing eye-catching text, graphics and hieroglyphics.

Your Elite's LCD panel lets you know which drives are being accessed, when battery power is low, what function keys are enabled, whether external power is being used and if there is a modem ring. All the information you desire is right before your eyes!

The wait is over for both you and the Pharaohs. Your Elite Notebook is here—and it's just a toll-free phone call away.

Treasures:

Processor:

Cyrix 486SLC2-50

Processing Speed:

50 MHz

RAM:

2 Mb RAM, expands to 8 Mb

Hard Drive:

120 Mb or 200 Mb

Floppy Drive:

Built-in 1.44 Mb 3.5"

Screen:

Color - 9", 256 colors
Monochrome - 10",
64 gray shades

Video RAM:

512K

Keyboard:

83 key with 101-key emulation
2-button thumbball mouse

Weight:

Color - 5.7 lbs. with battery
Monochrome - 5.4 lbs.
with battery

Battery Life*:

Color - 4 hours
Monochrome - 6 hours

640 x 480 resolution

Simultaneous video

Local Bus Video

Advanced Power Management

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1-800-243-0313

For your protection we check thoroughly for stolen credit cards. Prices and availability are subject to change. We are not responsible for errors in typography and photography. See policy statement for further details.

	120 Mb	200 Mb
Color	#005476 \$1639	#005477 \$1699
Monochrome	#005482 \$1259	#005483 \$1329

*Battery life measured with Power Management enabled. Actual battery life may vary.

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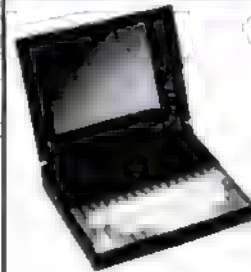
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SUPER SALE

	INTEL 90486 W/100 CPI	INTEL 80386 W/100 CPI	BASIC SYSTEM +120MB HD +14" MON & MCP CARD	BASIC SYSTEM +120MB HD +VGA CARD +VGA COLOR MONITOR	BASIC SYSTEM +120MB HD +VGA CARD +VGA COLOR MONITOR	BASIC SYS W/4MB RAM 1.2 & 1.44 FDD +120MB HD +VGA CARD +VGA COLOR MONITOR	BASIC SYS W/4MB RAM 1.2 & 1.44 FDD +200MB HD +VGA CARD +VGA COLOR MONITOR	BASIC SYS W/4MB RAM 1.2 & 1.44 FDD +340MB HD +VGA CARD +VGA COLOR MONITOR
486SLC2-60/84C VLB	\$258	\$418	\$658	\$768	\$788	\$858	\$1,018	\$1,888
486SLC2-50/84C VLB	228	388	628	738	768	828	888	1,058
486SLC2-40C VLB	458	618	858	968	988	1,158	1,218	1,288
486DX2-50/120C VLB	488	648	888	998	1,028	1,188	1,248	1,318
486DX2-50/120C VLB	348	508	748	858	888	1,048	1,108	1,178
486DX2-33C VLB	312	472	718	828	858	1,018	1,078	1,148
486SLC2-40/120C VLB	158	328	588	678	708	868	928	988
486DX2-50/120C HICE FISA VLB	598	758	1,048	1,118	1,148	1,308	1,368	1,438
486DX2-50/120C HICE FISA VLB	628	788	1,078	1,148	1,178	1,338	1,398	1,468
486DX2-50/120C HICE FISA VLB	488	648	888	1,008	1,038	1,198	1,258	1,328
486DX2-33/120C HICE FISA VLB	488	648	888	1,008	1,038	1,198	1,258	1,328
486DX2-40C ISA	448	608	848	958	988	1,148	1,208	1,278
486DX2-50/120C ISA	478	638	878	988	1,018	1,178	1,238	1,308
486DX2-50/120C ISA	348	508	748	858	888	1,048	1,108	1,178
486DX2-33/120C ISA	328	488	728	838	868	1,028	1,088	1,158
486DX2-40C ISA	318	478	718	818	848	1,008	1,068	1,138
486SX-33C ISA	184	344	582	672	702	862	922	982
486SX-25C ISA	132	292	532	642	672	832	892	962
486SLC2-40/120C ISA	144	304	542	652	682	842	902	972
386DX2-40/120C	102	262	502	612	642	802	862	932
386DX2-33	72	232	472	582	612	772	832	902
386DX2-33	68	228	468	578	608	768	828	898

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- 120MB HARD DRIVE
- 1.44 FLOPPY DRIVE
- 1 SERIAL / 1 PARALLEL
- BUILT-IN TRACKBALL
- BATTERY PACK
- CARRYING CASE
- MS DOS 6.2

Best Buy	VGA Mono	Dual Scan Color	Active Matrix Color
486SX-25	\$1,335	\$2,025	\$2,795
486SX-33	1,395	2,085	2,845
486DX-33	1,485	2,175	2,995
486DX2-50	1,585	2,285	3,045
486DX2-66	1,685	2,385	3,215

OPTIONS

- Upgrade to 8MB RAM Add \$268
- Upgrade to 20MB RAM Add \$1,548
- 200MB Hard Drive Add \$128
- 340MB Hard Drive Add \$328
- Internal Battery Pak Add \$94
- Internal Fax Modem Add \$128
- Pocket Fax Modem Add \$118
- Docking Station Add \$368

BASIC SYSTEM CONFIGURATION: Motherboard & CPU, 1MB memory, IDE 2HD/2FD controller w/25/120/14, 1 2MB or 1 44MB Floppy Drive, Internal Clock/Calendar, Enhanced Case with Power Supply, and 101-Key Enhanced Keyboard.

LOCAL BUS STOP

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486DX2-66 DX-50	\$1,278 / 1,248
486DX2-50 DX-33	\$1,128 / 1,118
486SLC2-66 SLC2-50	\$1,048 / 998

- Local Bus Motherboard
- Local Bus VGA Card w/1MB
- 14" Enhanced Case
- 120MB IDE Hard Drive

- 4MB RAM
- 1 200MB Floppy Drive
- 1 44MB Floppy Drive
- 101-Key Enhanced Keyboard

- 14" SVGA Monitor 250P
- VLB IDE 2HD/2FD Controller
- 25/120/14
- Docking or Mini Tower Case w/PS

NEW HARD DRIVES

120mb 15ms (IDE)	\$152
130mb 15ms / 170mb 17ms (IDE)	174 / 184
212mb 16ms / 250mb 14ms (IDE)	194 / 214
340mb 15ms / 540mb 12ms (IDE)	264 / 464
200mb 16ms (SCSI)	244
340mb 13ms (SCSI)	348
540mb 12ms (SCSI)	484
1.2GB 13ms (SCSI)	848
2.0GB 13ms (SCSI)	1,128

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80287-10	\$40
387SX-33 / 25	50 / 48
387DX-40 / 33	54 / 52

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Citizen GSX-190 (9-Pin)	\$158
Citizen GSX-230 / 240 (24-Pin)	248 / 298
Citizen GSX-145 (24-Pin)	378
Color Option for Citizen Printer	46 / 68
Panasonic KX-P1150 / 2023	138 / 198
Panasonic KX-P2123 / 2124	218 / 316
Panasonic KX-P1624 / 2624	378 / 396

KEYBOARDS

101 Enhanced Keyboard (Mitsumi)	\$16
Maxiswitch / Keytronics	28 / 30
MaxiPro II (124 Key Programmable)	54
Focus 2001 / 7000 (w/Trackball)	36 / 54
Focus 8000 (w/Calculator) / 9000	48 / 58
Omnikey 101NI / 102 / Ultra	68 / 68 / 98

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1MB SVGA Card (1024x768x256)	56
Windows Accelerators w/1MB	58
Trident / Cirrus Logic w/1MB (VLB)	76 / 76
Genoa 8500 VLB w/1MB	98
ATI Graphic Ultra w/Mouse	154
ATI Graphic Ultra Plus w/2MB	226
ATI Graphic Ultra Pro w/2MB	320
ATI Graphic Ultra Pro VLB w/2MB	324
Diamond Speed Star Pro VLB / ISA	106
Diamond Stealth 24VLB w/1MB	146
Diamond Viper VLB w/2MB	368
Orchid Fahrenheit 1280+ w/1MB	138
Orchid Fahrenheit VLB w/1MB	144
Orchid Celsius VLB: 1MB / 2MB	204 / 268
MAG 15F (15") / 17F (17")	494 / 870
Nanao F340hw / F550hw	544 / 1,098
Nanao T560i / T660i	1,656 / 2,398
NEC 3V / 4FG / 5FG	548 / 676 / 1,064
Sony 1430 / 1604 / 1730	548 / 928 / 974
Viewsonic 4E / 6E / 14E	264 / 284 / 344
Viewsonic 15E / 15	384 / 454
Viewsonic 17G / 17 / 20	844 / 964 / 1,544
Hitachi CM-2095 (20")	1,294
14" Mono / VGA Mono	80 / 100
14" VGA (640x480, 0.51)	170
14" Super VGA (1024x768, 0.39)	190
14" Super VGA (1024x768, 0.28)	220
14" Super VGA (1024x768, 0.28) NI	240
15" Super VGA (1280x1024, 0.28)	334
17" Super VGA (1280x1024, 0.28)	594

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Creative Sound Blaster Pro Deluxe	110
Mediavision Pro Audio Spectrum 16	138
Mitsumi or SONY CD-ROM w/Card	140
Panasonic CD-562 Dbl. Speed w/Card	198
Chinon CDS535 (SCSI) Internal	324
Toshiba XM-3401B 200ms (SCSI)	338
Trantor (SCSI) Host with Driver	50
Creative Edutainment CD16 Upgrade Kit	466
Speakers System	10

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IDE 2FD/2HD Cache Controller (OK)	\$88
Vesa Local Bus IDE	28
Adaptec SCSI 1542CF / 1542CFK	178 / 235
Adaptec SCSI 2742TK (EISA)	368
Bustek SCSI 445S (VLB)	275

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Fax Modem (9600 Fax, 2400 Modem)	40
Fax Modem (14,400 Fax, 14,400 Modem)	112
US Robotics 14,400 FM Int / Ext	150 / 168
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Logitech Mouseman Serial / Bus	50 / 62
Microsoft Mouse Serial / Bus	36 / 58
Conner Tape Backup 250MB	130
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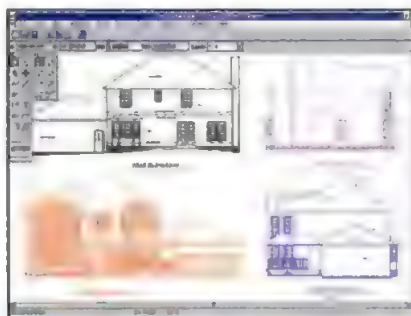


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IRAN

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NEW	AMBER Enterprise 486, Hardfile 486, Sprinco 486 (all models)			
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596

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2MB K9	\$81
2MB K9	\$81
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IBM

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PS/2 386X, 15, 405X, PS/Valuepoint Cxx series	\$181
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2MB	64S0111
	\$76

NEC

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Proline	3/25s, 3/25s				
2MB	141738-001	SMB	141742-001		\$319
Proline	4/75s, 4/33, 4/50				
	141684-001	SMB	141685-001		\$354
Des-P	384/20, 20s, 25				
4MB Module	113132-001				\$180
4MB	13645-001				\$244
Des-P	384/16				
4MB Module	112534-001				\$180
4MB	112634-001				\$255
Des-P	3/25s, 3/4, 4/25s	33s, 46s, 784s, 384s, 384S/2, 20s, 20M			

IBM Continued

[illegible]

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RAM	410-12002	5101	16MB	410-12003	\$647
Remedy	425, 433				
PowerMate	APC	5195	16MB	N/A	\$649
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OP	410-62105	5101	16MB	OP-410-6206	\$640
PowerMate 386/25, SX/16, SX/20					
2MB Kit	OP-410-8103				\$96
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OP	410-2101				\$319
PowerMate 386/20					
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PowerMate 386/20, 25					
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Toshiba 1900	4MB	PC-PA2012U	\$399	\$219
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T8100SX, XT800SX, SXE	2MB	579
	4MB	5169
T3200	3MB	5159
FX Series	4MB	5169
	8MB	5299
T4400, T6400 (all models)	4MB	5209

Zenith

Z Lake 370L	2900	5159
Z Mono 370L, 320Lh, 325L, 325Lx	2900	5100
	2900	5304
Z Mole 475 Series	2900	5549
Z Sport 470S, 475S	4000	5183
MastersPort 3045X, 51C, 51u	2900	570
MastersPort 3045X	2900	589
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Location 8-14

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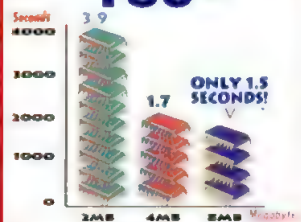
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200	02404A	S97	0000	02404A	\$310
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Vectra 330, 75, 406/250, 406/330, 406/500, 436/660					
200	02501A	S76	0000	02152A	\$354
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 - Reduces your system's need to access the hard disk
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- The graph displays the amount of time it takes to run one cycle*
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2MB	1291317	5115	3.5MB 1030865
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4MB	1328363	5167	0MB 1328365
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Dell/Lenovo 800			
1MB	70014701	567	2MB N/A
Dell/Lenovo 820			
2MB	N/A	5157	4MB N/A
Formaltec/Lenovo/Prime 4410, 4430			
2MB	K1-P444	5143	4MB N/A
Panasonic/Lenovo/Prime 4450, 4470			
2MB	K1-P441	5179	4MB N/A
Toshiba/Lenovo's Microdrive 1			
1MB	755539-0001		

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Media Vision	
Media Vision Fusion CD16, Internal	\$419
Media Vision Double Fusion CD16, Internal	\$519
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FAX/MODEMS



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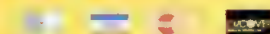
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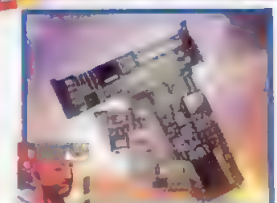
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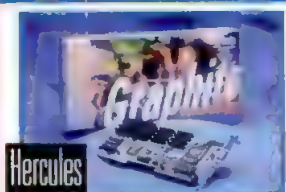
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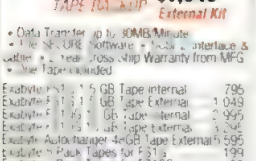
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ϵ	0.001	1/s
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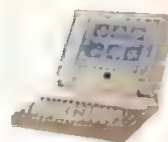
Hard Drive	Price
120MB	\$1999
170MB	\$2369

Lease for \$73/mo.

\$1629*

Screen	Hard Drive	Price
Mono	170MB	\$1629*
Dual Scan	200MB	\$2299

Lease for \$59/mo.



Z-STAR

Z-NOTE+

Processor	Screen	Hard Drive	Price
486SL/33	Mono	200MB	\$2594
486SL/33	Active	200MB	\$4199

Lease for \$96/mo.

Zenith Data Systems Accessories

Extra battery for Z-NOTE+	\$149.99
Extra battery for Z-STAR	\$129.99
Extra battery for Z-LITE	\$149.99

COMPAQ

Concerto

- ▲ 9.5" mono display
 - ▲ 2 PCMCIA Type II slots
 - ▲ Integrated, detachable keyboard
- | Processor | Hard Drive | Price |
|-----------|------------|--------|
| 486SL/25 | 120MB | \$2359 |
| 486SL/25 | 250MB | \$2649 |
| 486SL/33 | 250MB | \$2929 |

Lease for \$87/mo.

\$1999*



Concerto

LTE Lite 4/25

Screen	Hard Drive	Price
Mono	120MB	\$1999
Mono	209MB	\$2199
Active Mono	120MB	\$2799
Active Mono	209MB	\$3099

Lease for \$73/mo.

Centura 4/25

Screen	Hard Drive	Price
Mono	209MB	\$2199
Dual-Scan	209MB	\$2819*
Active Matrix	209MB	\$3449

Lease for \$81/mo.

Canon

Notejet Computer

- ▲ 2 PCMCIA Type II Slots
 - ▲ Built-in Inkjet printer;
 - ▲ 360dpi resolution
 - ▲ Automatic sheet feeder included
- | Processor | Hard drive | Price |
|-----------|------------|---------|
| 486SLC/25 | 135MB | \$2399* |
| 486SLC/25 | 180MB | \$2599 |

\$2399*



Notejet



Bravo NB

- ▲ 486SX/25 processor
- ▲ Accelerated local bus graphics
- ▲ PCMCIA Type III slot

Screen	Model	Hard Drive	Price
Mono	123W	120MB	\$1639*
Mono	173W	170MB	\$1799
Dual scan	123W	120MB	\$2279
Dual scan	173W	170MB	\$2399
Active matrix	173W	170MB	\$2899

Lease for \$60/mo.

\$1639*



Bravo NB

Bubblejet Printers

BJ105x-portable, 110cps, 3 7/8s	\$259.99
BJ200, desktop, 248cps	\$299.99
BJ230, 11"x17" capacity	\$419.99
BJC600 Color inkjet, 360dpi	\$589.99

2-year warranty included

PowerExec

Model	Screen	Price
4/25SL Model 203/W	Mono	\$2399
4/25SL Model 203/W	Active color	\$4029
4/33SL Model 203/W	Mono	\$2629
4/33SL Model 203/W	Active color	\$4229
4/33SL Model 343/W	Active color	\$4629

Lease for \$88/mo.

Compleat Your System With These Great Peripherals

New Media

Visual Media SCSI PCMCIA Adapter	\$219.99
WAVjammer PCMCIA sound card	\$279.99



Bus Toaster SCSI-2 PCMCIA Adapter

\$269.99

Practical Peripherals

14 4/14 4 internal PM14400FX	\$169.99
14 4/14 4 external PM14400FXMT	\$189.99
96/69 internal PM9600FX	\$149.99
96/96 external PM9600FXMT	\$159.99
14 4/14 4 pocket PM14400FXPPM	\$299.99
14 4/14 4 PCMCIA PRACTICARD144	\$299.99

Maxtor

Hard Drives	Price
PCMCIA, 105MB Drive, Type III	\$469.99
DeskRunner, Drive Bay Adapter	\$139.99
130MB IDE Drive	\$199.99
245MB IDE Drive	\$249.99
345MB IDE Drive	\$309.99

MiniStar

Hard Drives	Price
PCMCIA, 42MB/84MB, Type III	\$389.99
PCMCIA, 85MB/170MB, Type IV	\$459.99
PCMCIA, 128MB/256MB, Type IV	\$609.99
DockIt Socket, Drive Bay Adapter	\$169.99

Logitech

Scanners	Price
ScanManEasytouch, portable	\$229.99
ScanMan256, w/OmniPage	\$219.99
ScanMan Color, HandHeld	\$449.99

Nisca

PAGE portable full page B/W scanner	\$559.99
Spectra portable color scanner	\$599.99

Global Software Support

HELP Technical Support Service

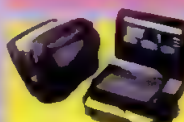
- ▲ 24-hour day, 7 days/week
- ▲ Toll Free 800 number
- ▲ Unlimited calls
- ▲ All hardware/software supported
- 90 Day Account \$44.99
- 1 Year Account \$94.99
- Soft-Lite Support \$18.99*

*call for details

Special Software Deal

Managing Your Money v 1.0	\$9.99*
TaxCut 1993 Final Edition	\$9.99*

*when purchased with a system



Luxurious Leather \$99.99

- Padded computer section with divider
- 3 section compartment for files
- Pockets for disks, pens, & business cards
- External pocket 13" x 9"

Also from Targus

Prestige Leather (3 colors)	\$224.99
Business Traveler	\$199.99
Premier Leather	\$149.99
Business Communicator	\$124.99
Universal Case	\$89.99
Notepad (5 colors)	\$39.99



Lifetime Replacement Warranty

Toshiba Direct

Portégé T3400

- ▲ Ultra-portability at only 4.1 lbs. (4.4 lbs. for color) and 9.9"W x 7.9"D x 1.7"H
- ▲ 486SX/33 processor
- ▲ 120MB hard drive
- ▲ 4MB RAM, expandable to 20MB
- ▲ PCMCIA Type II slot
- ▲ External 3.5" disk drive
- ▲ Integrated AccuPoint™ pointing device

Screen	Price
Monochrome	\$2259*
Active color	\$3469

Lease for \$82/mo.*



AccuPoint pointing device

\$2259*

T3400 Mono

T4700

- ▲ 486DX2/50 processor
- ▲ 8MB RAM, expandable to 24MB
- ▲ Brilliant 9.5" display with local bus video
- ▲ 2 PCMCIA slots (1 Type II, 1 Type III)
- ▲ Microsoft Sound System, built-in microphone, audio out port
- ▲ MS-DOS, Windows 3.1, UltraFont & Indeo video compression software

Screen	Hard drive	Price
Dual scan color	200MB	\$3999*
Dual scan color	320MB	\$4329
Active color	200MB	\$4599
Active color	320MB	\$4949

Lease for \$147/mo.

\$3999



T4700 Dual Scan

T1910

- ▲ 486SX33 processor
- ▲ 4MB RAM, expandable to 20MB
- ▲ 9.5" display
- ▲ Type III PCMCIA slot
- ▲ 82-key keyboard
- ▲ MS-DOS, Windows 3.1
- ▲ Ballpoint mouse 2.0 with Quickport
- ▲ Enhanced power management

Model	Screen	Hard drive	Price
T1910	Monochrome	120MB	\$1499
T1910	Dual scan color	120MB	\$2119
T1910	Dual scan color	200MB	\$2329

Lease for \$55/mo.

\$1499

T1950

- ▲ 486DX2/40 processor
- ▲ 4MB RAM, expandable to 20MB
- ▲ 9.5" display
- ▲ Type III PCMCIA slot
- ▲ 82-key keyboard
- ▲ MS-DOS, Windows 3.1
- ▲ Ballpoint mouse 2.0 with Quickport
- ▲ Enhanced power management

Model	Screen	Hard drive	Price
T1950	Monochrome	120MB	\$1899
T1950	Monochrome	200MB	\$2099
T1950	Dual scan color	120MB	\$2499
T1950	Dual scan color	200MB	\$2719
T1950	Active color	120MB	\$2849
T1950	Active color	200MB	\$3069
T1950	Active color	320MB	\$3399

Lease for \$70/mo.

\$1899

T4600

- ▲ 33MHz 486SL processor
- ▲ 4MB RAM, expandable to 20MB
- ▲ 9.5" display
- ▲ 2 PCMCIA slots
- ▲ Ballpoint mouse with QuickPort
- ▲ MS-DOS 6.0, Windows 3.1

Screen	Hard drive	Price
Monochrome	200MB	Call
Active color	120MB	\$3889
Active color	200MB	\$4099
Active color	320MB	\$4449

Lease for \$143/mo.

\$3889

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Desk Station IV

Toshiba's Desk Station IV turns your T4400, T4500, T4600, and T4700 into a full-function desktop computer by providing

- ▲ 2 full-size, 16-bit industry standard expansion slots
- ▲ 5.25" half-height drive bay
- ▲ Parallel, serial, PS/2 mouse, VGA monitor, 101-key keyboard ports and 1 floppy disk drive port
- ▲ Separate monitor stand
- ▲ Monitor, notebook and keyboard extra

\$599⁹⁹



TOSHIBA

Texas Instruments



4000E WinDX2/50 Active Matrix

- ▲ 486DX2/50 processor
- ▲ 4MB RAM expandable to 20MB
- ▲ 8.4" active matrix color display
- ▲ 200MB hard drive
- ▲ Enhanced high-speed video
- ▲ 4mm full travel keyboard
- ▲ MS BallPoint with QuickPort
- ▲ MS DOS 6.0, Windows 3.1

\$3799*

Lease for \$125/mo.

4000E WinSX/25

- ▲ 486SX/25 processor
- ▲ 4MB RAM expandable to 20MB
- ▲ 10" monochrome display
- ▲ 120MB hard drive
- ▲ Enhanced high-speed video
- ▲ MS DOS 6.0, Windows 3.1

Lease for \$62/mo.

\$1679*



4000E WinSX/25 Color

- ▲ 486SX/25 processor
- ▲ 4MB RAM expandable to 20MB
- ▲ 8.2" enhanced color display
- ▲ 120MB hard drive
- ▲ Enhanced high-speed video
- ▲ MS DOS 6.0, Windows 3.1

Lease for \$77/mo.

\$2099*



4000E WinDX2/50

- ▲ 486DX2/50 processor
- ▲ 4MB RAM expandable to 20MB
- ▲ 10" monochrome display
- ▲ 200MB hard drive
- ▲ Enhanced high-speed video
- ▲ MS DOS 6.0, Windows 3.1

Lease for \$89/mo.

\$2429*



TravelMate Intelligent Docking System

- ▲ Instantly transforms your TravelMate notebook into a full-sized, full-featured 486 desktop PC
- ▲ 6 16-bit expansion slots
- ▲ 2 PCMCIA Type III slots
- ▲ 4 internal drive bays- EPP parallel, 2 serial, VGA, mouse, keyboard, RJ-11 jack and game ports
- ▲ Designed for all TravelMates with QuickPort connectors

\$799.99

4000E WinDX2/40 Color

- ▲ 486DX2/40 processor
- ▲ 4MB RAM expandable to 20M
- ▲ 8.2" enhanced color display
- ▲ 200MB hard drive
- ▲ Enhanced high-speed video
- ▲ MS DOS 6.0, Windows 3.1

Lease for \$99/mo.

\$2699*



4000E WinDX2/50 Dual Scan Color

- ▲ 486DX2/50 processor
- ▲ 4MB RAM expandable to 20MB
- ▲ 9.4" dual scan color display
- ▲ 200MB hard drive
- ▲ Enhanced high-speed video
- ▲ MS DOS 6.0, Windows 3.1

Lease for \$110/mo.

\$2999*



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WinDX2/50
August 1993

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WinSX/25
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WinSX/25 Color
August 1993

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NEC: Ready and VERSAtile...

MultiSync Monitors

View the latest in the line of award-winning monitors, which include a 3-year warranty!

3V

- ▲ 15" SVGA
- ▲ 1024x768, .28mm ni
- ▲ 72MHz VESA refresh rate
- ▲ MPR II, EnergyStar compliant
- ▲ Great for Entry-level business/Windows applications



\$519.99

5FGp

- ▲ 17" SVGA
- ▲ 1280x1024, .28mm ni
- ▲ Opticlear surface
- ▲ Intelligent Power Management System
- ▲ Great for entry-level CAD, color desktop publishing



\$1359.99

6FGp

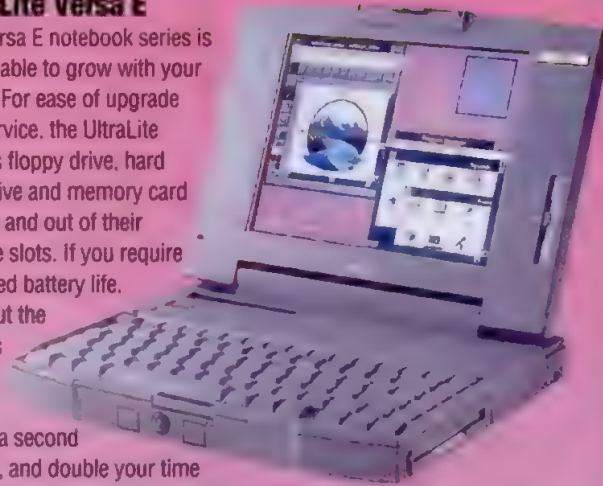
- ▲ 21" SVGA
- ▲ 1280x1024, .28mm ni
- ▲ Opticlear surface
- ▲ Intelligent Power Management System (IPM)
- ▲ Great for professional CAD/CAM/CAE, graphic design, color desktop publishing

\$2369.99

NEC

UltraLite Versa E

The Versa E notebook series is upgradable to grow with your needs. For ease of upgrade and service, the UltraLite Versa's floppy drive, hard disk drive and memory card slide in and out of their storage slots. If you require extended battery life, slide out the Versa's floppy drive, pop in a second battery, and double your time on the road. And, in response to customer requests, the new Versa E series features front-mounted VeraTrack integrated trackball, a smaller AC adapter, lightning fast accelerated Local Bus video and a brighter color screen.



UltraLite Versa E

- ▲ 486 processor
- ▲ 4MB RAM, expandable to 20MB
- ▲ 2 Type II PCMCIA slots
- ▲ MS-DOS 6.2, Windows 3.1, built-in trackball

Processor	Screen	Hard drive	Price
DX2/40	Monochrome	120MB	\$2579*
DX2/40	Monochrome	250MB	\$2989
DX2/40	Active color	120MB	\$3819
DX2/40	Active color	250MB	\$4229
DX2/50	Monochrome	209MB	\$3259
DX2/50	Monochrome	340MB	\$3669
DX2/50	Active color	209MB	\$4499
DX2/50	Active color	340MB	\$4919

Lease for \$95/mo.

\$2579*

Ready Multimedia Desktops

Get Ready for an impressive multimedia system, new from NEC. The Ready 425CD2 and Ready 433CD3 feature built-in ready-to-run CD-ROM readers, a complete sound system, and a comprehensive software offering to introduce you to multimedia computing. Also sporting local bus graphics

and 24-bit true color, the multimedia Ready will speed through your applications and display them in bright, clear colors.



Ready Multimedia Desktops

- ▲ 4MB RAM expandable to 36MB
- ▲ 9600-4800 fax, 2400 data modem
- ▲ Local bus graphics
- ▲ Fast double or triple speed CD-ROM drives
- ▲ MediaVision 16-bit stereo sound
- ▲ Labtec speakers, headphone, and microphone
- ▲ MS-DOS 6.0, Windows 3.1, America-On-Line, CompuServe
- ▲ CD-ROM titles include PFS, Window Works, Compton's Encyclopedia, Dinosaur Adventure and Space Adventure

Processor	Hard drive	Price
486SX/25	170MB	\$1499*
486SX/33	250MB	\$1899

Lease for \$55/mo.

\$1499*

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NEC MultiSpin 3X CD-ROM Drives

New from NEC—the fastest CD-ROM Drives available

- ▲ Triple speed 450Kb/sec transfer rate, 195ms access time & 256K buffer
- ▲ MPC Level 2 compliant, Multisession Photo CD & XA-compliant
- ▲ Sleek new design features front panel LCD controls for display of data, audio & diagnostics data
- ▲ Full audio control buttons (play, repeat, track advance, pause, stop) on front panel for your music CDs. And play audio CDs without a PC

MultiSpin 3Xp Portable Drive \$429.99

MultiSpin 3Xi Internal Drive \$479.99

MultiSpin 3Xe External Drive \$569.99



Call about NEC's new Quad speed drive!

LEADING EDGE

VL Bus Desktops		
Processor	Hard drive	Price
486SX/25	170MB	\$919*
486SX/33	170MB	\$1009
486DX/33	260MB	\$1249
486DX/50	345MB	\$1609
486DX/66	345MB	\$1699

*VGA color monitors begin at \$229.99
Lease for \$50/mo.



VL Bus Desktops

VL Bus Minitowers		
Processor	Hard drive	Price
486DX/33	260MB	\$1309*
486DX/50	345MB	\$1669
486DX/66	345MB	\$1839

*VGA color monitors begin at \$229.99

WinPro 486SLC Series			
Processor	Hard drive	Monitor	Price
486SLC33	120MB	14" VGA	\$979
486SLC33	170MB	14" SVGA	\$1059

COMPAQ

ProLinea Desktops		
Processor	Hard Drive	Price
486SX/33	120MB	\$1109
486SX/33	240MB	\$1259
486DX/33	120MB	\$1389
486DX/33	240MB	\$1469
486DX/33	340MB	\$1619

Lease for \$50/mo.

ProLinea Net1
\$1329

Lease for \$50/mo.



ProLinea Desktops

ProLinea MT			
Processor	RAM	Hard Drive	Price
486SX/33	4MB	270MB	\$1399
486SX/33	4MB	340MB	\$1499
486DX/66	8MB	525MB	\$2469

Lease for \$51/mo.

DeskPro/M			
Processor	RAM	Hard Drive	Price
486DX/33	8MB	240MB	\$2659
486DX/33	8MB	340MB	\$3069
486DX/66	8MB	510MB	\$3739

Lease for \$98/mo.

AST
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Reseller

Bravo LC		
▲ 4/8MB RAM exp. to 64MB		
▲ 120/170/210MB hard drive		
Model	Hard Drive	Price*
4/25s Model 123W	120MB	\$999
4/33 Model 123W	120MB	\$1299
4/33 Model 173W	170MB	\$1359
4/33 Model 213W	210MB	\$1539
4/66d Model 213W	210MB	\$1979

*Monitors sold separately
Lease for \$50/mo.



Bravo LC

Bravo MT		
Model	Hard Drive	Price*
4/33 Model 3	Optional	\$1239
4/33 Model 173W	170MB	\$1519
4/33 Model 343W	340MB	\$1979
4/66d Model 3	Optional	\$1659
4/66d Model 173W	170MB	\$1929
4/66d Model 343W	340MB	\$2399

*Monitors sold separately
Lease for \$50/mo.

Cygnal

Desktop Systems		
RAM	Video	Price
8MB	20M-Wm	\$2149*
16MB	20M-Wm	\$2479
16MB	60M-Wm	\$2699

Lease for \$79/mo.



Desktop Systems

Tower Systems		
ISA/EISA	Video	Price
ISA	20M-Wm	\$2149
ISA	60M-Wm	\$2699
EISA	20M-Wm	\$2879
EISA	60M-Wm	\$3099

Includes 16MB RAM

15" SVGA color monitor \$399.99

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Okidata

Laser Printers

OL400e, 4PPM, 300dpi, Energy Star	\$499.99
OL410e, 4PPM, 600dpi class output	\$699.99

Epson

Inkjet Printers

Stylus 300, Thermal inkjet, 4 fonts	\$249.99
Stylus 800, 360dpi, 100 sheet feeder	\$299.99

Laser Printers

Action Laser1000, 6PPM	\$629.99
Action Laser1500, 6PPM	\$649.99

Panasonic

Dot Matrix Printers

KX-P11241	\$239.99
KX-P2123	\$234.99
KX-P2124	\$317.99
KX-P1624	\$414.99
KX-P2624	\$439.99

Colorado

Tape drives

Jumbo 120MB, Internal	\$109.99
Jumbo 250MB, Internal	\$179.99
Trakker 120MB, External	\$219.99
Trakker 250MB, External	\$349.99

SONY

Trinitron MultiScan Monitors

14", 1024x768, .25mm aperture	\$559.99
17", 1024x768, Digital Image	\$1049.99
17", 1600x1200, Dynamic Focus	\$1199.99
20", 1280x1024, .30mm aperture	\$2279.99

Sony Multimedia

Desktop Library Upgrade Kit	\$459.99
CD-ROM drive, Internal, 2X, SCSI	\$319.99

Multimedia

Creative Labs Discovery 16 Kit	\$449.99
Creative Labs Edutainment 16 Kit	\$519.99
ProAudio Spectrum 16 sound card	\$159.99
SoundBlaster16 SCSI ASP sound card	\$224.99
Labtec CS-150 stereo speakers	\$19.99
Microsoft Sound System 2.0	\$139.99

CD-ROM Software

Choose any 3 titles for \$75 or 5 for \$100*

The Animals	\$34.99
Oceans Below	\$34.99
Capital Hill	\$34.99
Toolworks Reference Library	\$34.99
ChessMaster 3000 Pro	\$34.99
Monkey Island	\$34.99
The Space Shuttle	\$34.99
Loom	\$34.99
US Atlas 4.0	\$34.99
World Atlas 4.0	\$34.99
GamePak II	\$34.99
Marco is Missing Deluxe	\$34.99
Mavis Beacon Teaches Typing	\$34.99
Guinness Book of World Records	\$34.99

*when purchased with multimedia hardware

3COM

3C509 Etherlink III Coax	\$119.99
3C509 Etherlink III 10BT	\$129.99

Intel

EtherExpress 16 Coax	\$109.99
----------------------	----------

PCM-3/04B

EtherExpress 16 10BT

\$109.99

Software

Lotus SmartSuite Upgrade	\$289.99*/\$314.99
Lotus SmartSuite	\$374.99*/\$449.99
Lotus 1-2-3	\$259.99*/\$294.99
Lotus 1-2-3 Upgrade	\$99.99
Lotus Organizer	\$74.99*/\$99.99
WinFax Pro	\$59.99*/\$184.99
LapLink V	\$69.99*/\$109.99
Norton Utilities 7.0	\$79.99*/\$119.99
Norton AntiVirus 3.0	\$59.99*/\$89.99
Norton Desktop 1/Win 3.0	\$79.99*/\$119.99
PFS:WindowWorks	\$39.99*/\$84.99

*Special price available when purchased with a system

Microsoft Office Version Upgrade	\$249.99
Microsoft Office Competitive Upgrade	\$289.99
Microsoft Office	\$449.99



Okidata
OL400e
\$499.99

- 4PPM, 300dpi
- 44-bit-mapped fonts
- Energy Star

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The Best Brand Names	YES	
30-day Money Back Guarantee	YES	
Never a Restocking Fee	YES	
30-day Price Protection	YES	
PC Computing Five Star Award	YES	
Lifetime Toll-Free Technical Support	YES	
FREE Hardware Configuration	YES	
FREE Software Installation	YES	
Same Day Shipment	YES	
Pre-Installed Software Discount	YES	
All Major Credit Cards Accepted	YES	
Never a Hidden Surcharge	YES	
\$4.95 Shipping on Most Peripherals	YES	
Compaq Authorized for Direct Marketing	YES	
90 Days Same As Cash	YES	
Low Cost Business Leases	YES	
Volume Purchase Agreements	YES	
FREE Asset Tagging	YES	
Customer Satisfaction Is Top Priority	YES	



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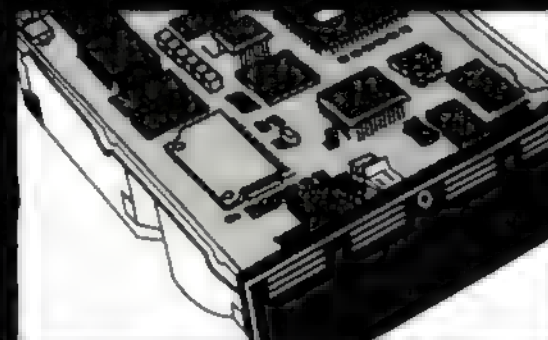
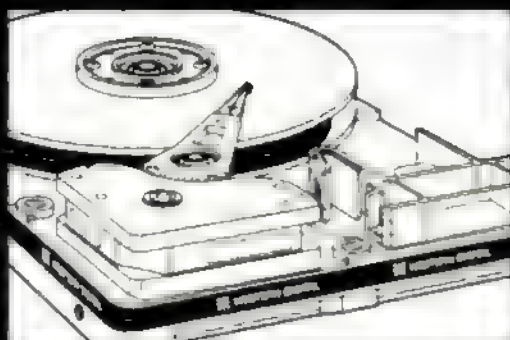
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Our multi-million dollar inventory offers you the best diversity and availability in the market. We ship most orders the same day. Each order is checked at least four times for accuracy.

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Anyone can sell you a hard drive. We sell easy to install storage solutions. We spend countless hours researching the best solutions, then create our quick precise installation guides for each kit.

SPECIALS



SyQuest

Now available 270MB!

SQ3105A IDE Drive Bare \$239
with GSI-18 & 1 disk \$329
Portable external, attaches to printer port with 1 cartridge \$399

105MB Removable Media Drive. The #1 storage solution for the 1990's. Hard drive speed (14.5ms). Low cost per MB. Mounts in 3 1/2" or 5 1/4" bay. Great for unlimited upgradability, data archival, transport & exchange, just to name a few.

SQ3105S SCSI Drive Bare \$279
with Adaptec 1522 & 1 disk \$399
with Adaptec 1542 & 1 Disk \$529
External for Macintosh & 1 Disk \$399



GSI drive accelerators increase the data transfer rate of your IDE drive 30 to 80%. Works by enabling the drives Read Multiple & Write Multiple commands to greatly increase performance. We highly recommend these products for WD, Conner, Quantum, Seagate, Micropolis, Maxtor, & Fujitsu. Alone w/Drive

GSI-21 Board supports 2 IDE, 4 floppy drives. Doubles QIC-80 tape drive speed	\$65	\$55
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SCSI			
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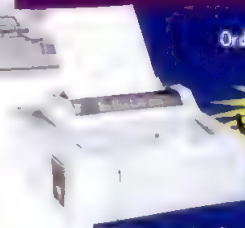
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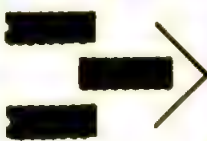
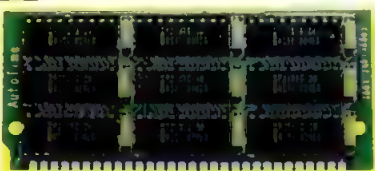
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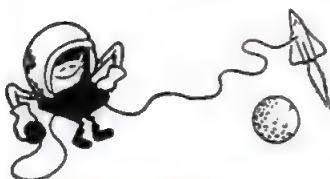


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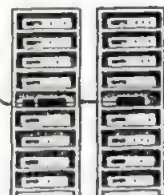
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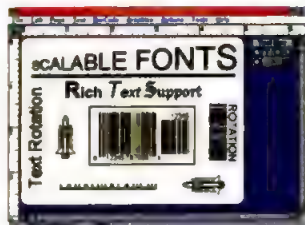


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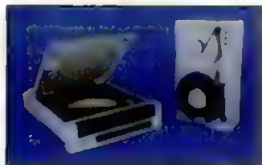
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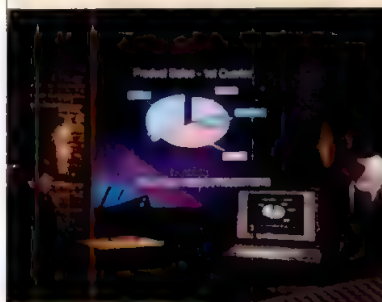
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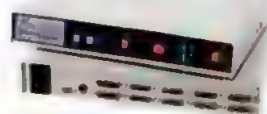
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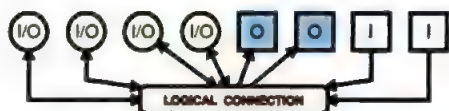
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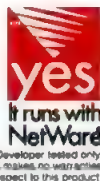
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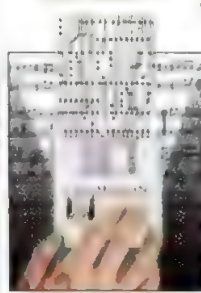


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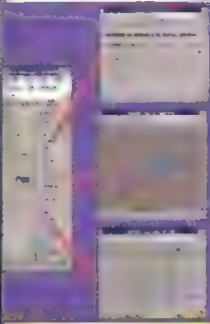
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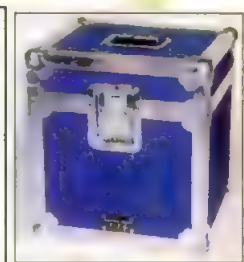
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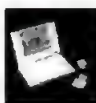
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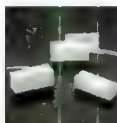
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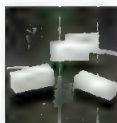
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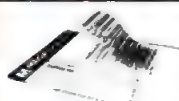
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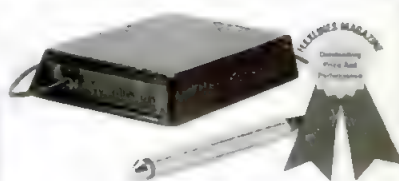
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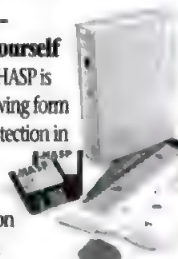
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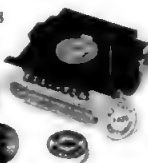
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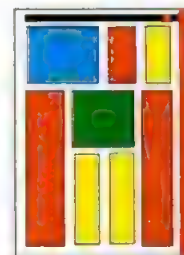
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1. Do you work in a DP/MIS dept.?
01 ☐ Yes 02 ☐ No

2. Please indicate your company or organization's primary business activity: (Check one)

- 01. ☐ Manufacturer/Computer Equip., Computers, Software
- 02. ☐ Manufacturer-Aerospace
- 03. ☐ Manufacturer-Other
- 04. ☐ Systems House
- 05. ☐ Computer Consultant
- 06. ☐ Computer Retailer/VAR/VAD Distributor
- 07. ☐ Communications
- 08. ☐ Finance/Banking/Insurance/Real Estate/Accounting
- 09. ☐ Education
- 10. ☐ Government
- 11. ☐ Research and Development
- 12. ☐ Data Processing/Computer Service
- 13. ☐ Health/Medical/Legal/Service
- 14. ☐ Engineering/Architecture

16. ☐ Agr./Const./Mining/Oil/Transp./Utilities

17. ☐ Non-Computer Retailer/Dist.

18. ☐ Other Business or Service

3. Please indicate your primary business function: (Check one)

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- 10. ☐ Production
- 11. ☐ Education/Training
- 12. ☐ Marketing/Sales
- 13. ☐ Medical/Legal
- 14. ☐ Admin./Mgmt.

4. Is your company a reseller?

- 01 ☐ Yes 02 ☐ No

5. For how many IBM PCs and compatibles do you specify brands of products:

- 01. ☐ 10 or less 03. ☐ 26-99
- 02. ☐ 11-25 04. ☐ 100 or more

6. Are there any PCs in your office?

- 01. ☐ Linked to mainframe
- 02. ☐ Linked to mini
- 03. ☐ Networked together

7. Please check the equipment currently installed at your location: (Check all that apply)

- 01. ☐ IBM or Compatible PCs
- 02. ☐ IBM or Compatible Mainframes
- 03. ☐ IBM or Compatible Minis
- 04. ☐ Multitask
- 05. ☐ CD-ROM
- 06. ☐ Windows

8. Do you plan to buy any PC products?

- 01 ☐ Now 03 ☐ In 7 to 12 months
- 02 ☐ In 4 to 6 months 04 ☐ No definite plans

9. Number of employees in your entire company:

- 01 ☐ 25 or less 03 ☐ 100-499 05 ☐ 1000 or more
- 02 ☐ 26-99 04 ☐ 500-999

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PC 3/29-5

Title

Telephone

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Coming Up

Pentium PCs

Pentium PCs are now available for the masses, but what do you really get for your computing dollar? We take a look at 31 60- and 66-MHz Pentium PCs priced from just under \$3,000 to well over \$7,000. Find out how well vendors have matched these powerful CPUs with today's cutting-edge video and hard disk technologies.

Chicago

Microsoft's next-generation Windows operating system—code-named Chicago—is coming off the drawing board. But at this early stage, it's tough separating fact from fiction. One thing we know for sure: The basic architecture of this bootable, 32-bit, preemptively multitasking, multithreaded OS makes a clean break with the DOS/Windows past. Our in-depth coverage goes under the hood to see how Chicago stacks up against other operating systems—and what it means for you in day-to-day use of hardware, applications, files, and networks.

Sound Boards

Suddenly, it seems as if new sound boards are appearing on the market almost daily. We subject 24 16-bit boards to PC Labs' high-level performance tests, rating each product on its ability to handle everything from games to mainstream business applications and professional-quality audio. Find out whether audio quality has improved since last year's roundup—and whether there actually is a sound board that's easy to install.

E-mail

As the LAN revolution transforms the business landscape, electronic mail becomes an ever-more-vital communications link. We examine eight industrial-strength e-mail systems that run on Intel-based servers and offer DOS, Windows, and remote client front ends. Our scrutiny extends to small-scale Windows-only mail packages, Lotus Notes Mail, voice annotation of e-mail, and upcoming developments on ways to integrate e-mail into the operating system.

Utilities

How many times have you executed a command under DOS, only to have the information you need scroll off the screen before you could read it? Want to be able to scroll back a few lines while you're on-line? Coming up in our Utilities column is SCROLL, a DOS TSR program that captures the screen display and lets you review the information at the touch of a key.

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After Hours

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HOME DESIGN

Planning for Your Dream House

BY DONALD B. TRIVETTE

Need to add a family room to your overcrowded house? If you're handy with the PC, you can bypass the architect and do the renovations yourself. These four new home-design programs can turn your dream house into working blueprints.

3D Home Architect. This one is the most intuitive of

pliances and furniture in place, drag the camera icon to the plan and aim it in the direction you want to view. In just seconds the software will construct a 3-D color view of the space you designed. You can move anywhere in the room to get an idea of what the space is like and even delete objects and make changes in color, all while in the 3-D mode. "Seeing" your design has never been easier.

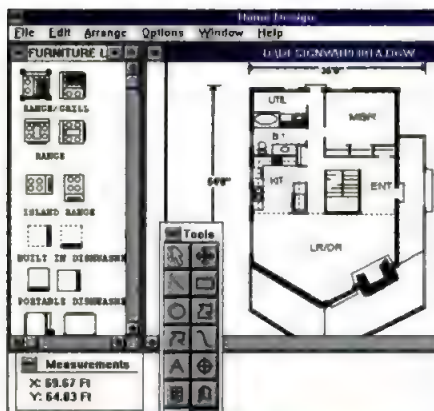
Included in 3D Home are 30 complete plans of all sizes that you can modify to fit your family and lifestyle. Many home-drawing packages have plans that are little more than a boxy collection of rooms. Not 3D Home. The houses it offers are gorgeous, open designs that will fit perfectly within even the finest communities.

Expert Home Design for

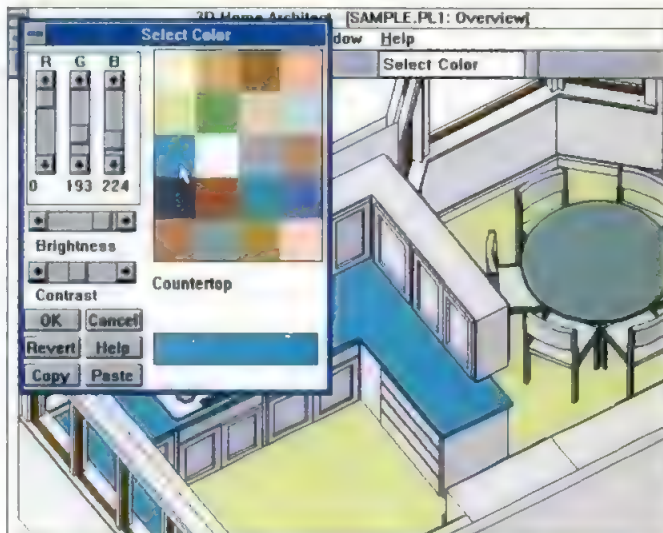
Windows, Gold Edition. Expert Home Design, too, incorporates modular drag-and-drop drawing techniques and

a stove, for example, become too thick to make the object easily recognizable.

The package comes with 25 popular home designs, some of which are identical (down to plan number) to those found in 3D Home Architect. Using a separate OLE-connected program called Cost makes



BUILD IT: Estimating is easy in Expert Home.



POINT-AND-CLICK: Mouse your way to a perfect home with 3D Architect.

has large libraries of appliances, equipment, and furniture for creating your dream house. The implementation is a little rough around the edges, though. Zooming in magnifies line widths on objects so much that the edges of

estimating a snap.

Expert 3-D Home Design for Windows. This one picks up where the Expert Gold Edition leaves off. The drawing techniques, libraries, and approach are much the same as in the 2-D package.

the design packages—and the easiest to grow comfortable with. To create a room, you simply pick a wall from the drawing palette and drag it along your plan to the proper dimension; it automatically connects to an adjoining wall. Pick a window, drop it on the wall where you want a window, and the wall is cut to accommodate it.

Once you have the floor plan constructed and the ap-

FACT FILES

3D Home Architect, \$60.00. Requires: 4MB RAM, VGA display, Microsoft Windows 3.0 or later; math coprocessor recommended. Broderbund Software Inc., 500 Redwood Blvd., Novato, CA 94948; 800-521-6263; fax, 415-382-4419.

Circle 479 on reader service card

Expert Home Design for Windows, Gold Edition, \$49.95; Expert 3-D Home Design for Windows, \$14.95. Requires: 2MB RAM, VGA display, Microsoft Windows 3.0 or later. Expert Software Inc., 800 Douglas Rd., Coral Gables, FL 33134; 800-759-2562.

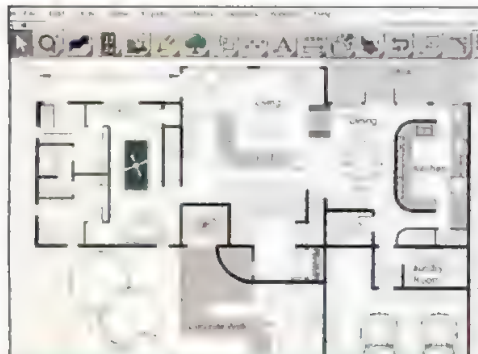
Circle 480 on reader service card

Planix Home for Windows, \$99.00. Requires: 2MB RAM, VGA display, Microsoft Windows 3.0 or later; math coprocessor recommended. Foresight Resources Corp., 10725 Ambassador Dr., Kansas City, MO 64153; 800-231-8574.

Circle 481 on reader service card

Home Design

The additions here are 3-D viewing capabilities that, unfortunately, are not as polished as they should be, and an interface that's less intuitive.



PRECISION: Planix Home makes measuring precise.

You create your design in 2-D mode here, then click on a 3-D icon to see it rendered into solid form. Be prepared for a long wait, though: Rendering and redrawing are painfully slow. If you must have 3-D, stick to the wire-frame view; it may not be as easy to visualize your designs this way, but it's considerably faster.

The package retails for a modest \$14.95, making it the least expensive 3-D home design tool, and it does give you some value for the money. There's a useful Navigator tool that lets you move around your 3-D environment in eight directions, and you can create multifloor designs and view them one floor at a time or all at once.

Planix Home for Windows differs from the other packages in this review in that its roots are firmly planted in the CAD world. This is both a plus and a minus. It means that you can draw and measure with precision but that the interface is a bit more complex than you might be comfortable with. Still, the package packs a lot of power.

While the other packages automate the drawing process by providing drag-and-drop symbols for furniture and walls, Planix goes them one better by adding an Automatic Builder that actually creates

your house plan for you. All you have to do is select a drawing type and enter a few coordinates; the package will do the rest. Of course, Planix also offers editable drag-and-drop symbols for furniture and appliances, as well as

for windows, doors, and landscaping.

Which package is right for you will depend as much upon how comfortable you are with drawing and designing on your own as it will on what type of designs you need to create. All bring your dream house one step closer to reality.

HOME REPAIR

Home Survival Toolkit

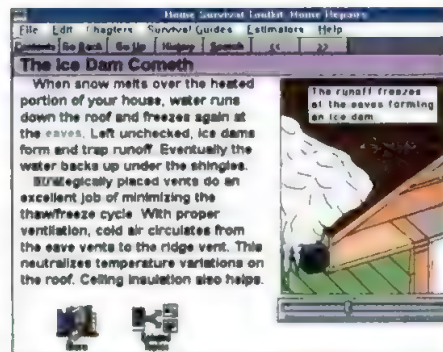
BY DONALD B. TRIVETTE

If you've ever wound up with four extra gallons of custom-mixed paint when redecorating or a ceiling leak that threatens to sink you, you'll appreciate Home Survival Toolkit, from Books That Work. This multimedia how-to guide explains how everything in your house works—and what to do when it doesn't.

Many topics include animated illustrations to explain and diagnose problems better; some entries even have accompanying sound effects. For example, one sequence shows how an ice dam builds up and causes water to

leak through a roof, then explains how to correct it. Most sections have icons you can click to find related topics and a list of tools you'll need to make the repairs.

Part of what makes this program indispensable is a se-



FIX IT: Home Survival Toolkit is a how-to whiz.

Exploring Ancient Architecture

If there are coffee-table CD-ROMs, surely Exploring Ancient Architecture qualifies as one.

With this disk, you can see Stonehenge through the eyes of a druid and visit the Parthenon in its prime. These are

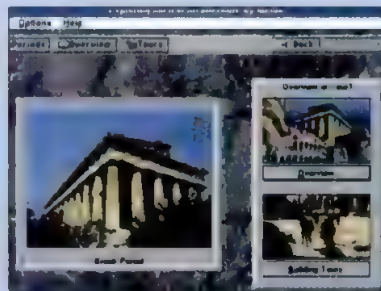
just two of the seven structures you can visit as the disk takes you on a grand tour of historic buildings.

No dull lectures or fuzzy slides here: An expert guide gives a narrated 3-D, photo-realistic walking tour of buildings from four major architectural periods, while a pointer on the floor plan marks your location. Directional arrows

let you choose a course as you explore chambers and rooms.

This animated walk-through gives a more realistic idea of a building than can be had from the finest architectural drawings.

—Donald B. Trivette.



Exploring Ancient Architecture, \$59.95. Media Multimedia Inc., 800-788-3868.

Circle 485 on reader service card

ries of Survival Guides and Estimators that help you figure out what materials to use and how much of them you'll need. For example, the Adhesives Survival Guide helps you find the right adhesive to bond more than 200 pairs of materials. You simply pick two materials to bond, specify drying time, and presto! the program tells you which glue will work best.

The Estimators are specialized calculators that help you figure out how much concrete you'll need to fill a hole, how much paint you'll need to turn the den from mauve to mulberry, and more.

Home Survival Toolkit, \$49.95. Requires: 2MB RAM, VGA display, Microsoft Windows 3.1 or later. Books That Work Inc., 285 Hamilton, #260, Palo Alto, CA 94301; 800-242-4546; fax, 415-326-916.

Circle 482 on reader service card

After Hours

GAMES

Leisure Suit Larry Shapes Up

BY NEIL J. RUBENKING

In Shape Up or Slip Out, archetypal dweeb Leisure Suit Larry unsuccessfully pursues gorgeous women who are smarter, taller, and far superior to him in every way, while gathering gifts for the one woman who can delude herself into accepting him. Sound familiar? Yes, it's much like Larry's first adventure in the Land of the Lounge Lizards, but with 256-color graphics, MIDI music, digitized sound effects, and more babes.

The game carries a voluntary rating of MA-17 (mature audiences) that you would do well to heed. The game isn't

exactly hard-core, but it is about as naughty as a *Playboy* magazine. You'll find a little frontal nudity in the game and



LARRY 6.0: Good, not-so-clean fun.

a lot of low humor. Larry does get into some embarrassing situations, though. While at the exclusive La Costa Lotta resort, Larry meets eight beauti-

ful women with unusual needs. To satisfy them, he'll try nude bungee jumping and experience electroshock exercise. Lounge singer Burgundy and ex-marine aerobics instructor Cavaricchi Vuarnet enjoy each other more than they do Larry; dominatrix Thunderbird puts Larry through obedience school; and cosmetology student Shablee turns out to have a very good reason for knowing what a man wants.

Larry doesn't find a soul mate until he meets the intellectual and introspective Shamara ("Sham") Payne in the resort's penthouse. If

Larry has the proper gifts for her, she'll welcome him into her life. The curtain closes on a montage of innocent yet suggestive video clips, with a musi-

cal score by Tchaikovsky as interpreted by Sigmund Freud and Spike Jones.

Game designer Al Lowe aims to amuse, not frustrate, so he doesn't let you accidentally kill off poor Larry. Go ahead and do the wrong thing! If Larry gets punched through the ceiling because he can't keep his hands to himself, you get a second chance.

Leisure Suit Larry 6.0: Shape Up or Slip Out, \$69.95. Requires: DOS installation: 640K RAM, VGA display, mouse, DOS 5.0 or later. Windows installation: 386SX-based PC or better, 2MB RAM, Microsoft Windows 3.0 or later; sound card recommended. Sierra On-Line Inc., P.O. Box 485, Coarsegold, CA 93614; 209-683-4468; fax, 209-683-3633.

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MULTIMEDIA

Video Cube: Space

BY BRAD GRIMES

Aris Multimedia Entertainment's Video Cube: Space gives that classic Rubik's Cube a digital twist. The first title in what will be a new line of multimedia CD-ROM games, Video Cube: Space combines music and video clips with a spin-twist-and-solve cubic puzzle.

Video Cube begins with an animated clip showing a cube tumbling through space with fragments of videos playing on its sides. When you start the game, all six sides of the cube are made up of scrambled still

photos. To solve the puzzle, you use a mouse to rotate the scrambled pieces until you put together a complete picture on each side of the cube. When you finish, your reward is viewing one of the more than 100 video clips of astronauts, celestial bodies, and spacecraft.

These first-rate video segments, which include rocket launches, moon walks, and aer-

ial views of the earth, have all been provided by NASA. The videos range in duration from a

FINAL FRONTIER:
Video Cube: Space gives the Rubik's Cube a winning digital twist.



few seconds to nearly a minute.

If you complete the task within the amount of time specified, you move up to the next level. There are 18 levels in all; the higher the level, the more pieces there are to rotate within each cube and the less time you have to fit them into their proper places. The game is designed to offer hundreds of variations in complexity of play.

Though there's no two-player option, there's a reason to excel at Video Cube (besides wanting to see as many clips as possible). When you begin work on a picture, you're given 1,000 points, and every rotation of a cube costs points. After you put together a picture, the points you have left over are added to your total score. The two ways you can lose the game are by running out of time or points.

Playing Video Cube is relatively easy, and you should expect to reach high levels right off the bat. You can save your game and come back to it later, but for some odd reason doing so costs you points. So if you're shooting for a high score, plan on sitting at your PC for a long time. Once you've mastered Video Cube: Space, look for new titles. Space probably won't be the final frontier in this series.

Video Cube: Space, \$49.95. Requires: 4MB RAM, SVGA display, Microsoft Windows 3.0 or later, CD-ROM drive and sound card. Aris Multimedia Entertainment Inc., 310 Washington Blvd., #100, Marina Del Rey, CA 90292; 800-228-2747, 310-821-0234.

Circle 484 on reader service card

SPOTLIGHT ON ACTION

Into the Future with Iron Helix

By Bernard Yee

For a look at the future of action gaming, check out Iron Helix, a true multimedia game that has megabytes of animation, digitized video, music and sound effects, all brought to you on CD-ROM.

The mood of this space adventure is dark, and its plot line is simple but clever: A runaway starship

ship is equipped with an armed probe that's out to destroy you.

In many ways, Iron Helix is like a strategy game, de-

path through hallways reminiscent of those in the original *Alien* movie.

The music and sound effects are first-rate, but this game requires a lot of horsepower. Play did not seem exceptionally smooth even running with the recommended double-speed CD-ROM drive on a 486/33. But technical niceties aside, what is most enjoyable about Iron Helix is its moody, dark atmosphere.



MOODY: The future looks dark and threatening.

away starship with a doomsday weapon is barreling towards a peaceful planet, and your science vessel is the only ship in intercept range. You can't shoot the ship down, but you can send one of your three all-purpose probe units on-board to figure out how to destroy it. To make matters worse, the runaway

spite its real-time, first-person sense of urgency. You'll have to use your wits rather than your weapons to survive. Movement here is executed in the same way as in Virgin Games' action/mystery game, 7th Guest: Your viewpoint is fixed, and your probe swoops along a set

Iron Helix, \$99.95. Requires: 386/25-based PC or better, 4MB RAM, hard disk, Microsoft Windows 3.0 or later, CD-ROM drive with 150-kilobit-per-second data-transfer rate, Creative Labs Sound Blaster-compatible sound card. Spectrum Holobyte Inc., 2490 Mariner Sq. Loop, Alameda, CA 94501; 510-522-3584.

Circle 486 on reader service card

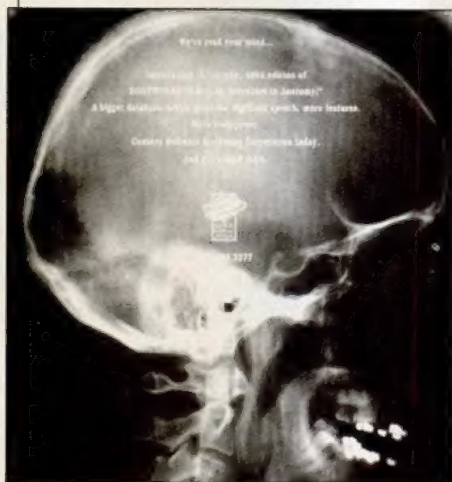
Abort, Retry, Fail?

THE LIGHTER SIDE OF PERSONAL COMPUTING

By Don Willmott

Exciting New Printer Feature!

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Software Marketing Corp. announced the release of **Bodyworks 3.0** by sending editors an actual skull X ray of a person with very bad teeth.

Math Majors, This One's for You

"Since mid-summer 1993, the domestic market share for WordPerfect (for DOS) has grown to 92 percent—more than double our nearest competitor."

—WORDPERFECT REPORT



Dave, Meet Mike. Mike, Dave.

"Don't you just hate those holiday columns where some dubious intellect proclaims the next annum as the year of this or that?"—DAVID COURSEY, *PC WORLD*, DECEMBER 1993, PAGE 51

"Call it the Year of the Local Bus."
—MICHAEL DESMOND, *PC WORLD*, DECEMBER 1993, PAGE 221

The magic Shaker-style computer. (Hold Everything catalog.)

Classified Intelligence

"R.R. Donnelley & Sons . . . [has] an increased need for individuals with word processing, typesetting, and desktop publishing skills. Individuals will be suing both proprietary software as well as common desktop systems on both IBM and Mac platforms."

—THE LOS ANGELES TIMES

"HULA PACKERS Deskwriter inkjet printer for Macintosh, like new, \$225."

—DETROIT TRADIN' TIMES



ARF on the road:
South Dallas, Texas.

That Cute Little Bug

"Advanced users of templates and macros may encounter crush-inducing bugs."—PC MAGAZINE



"Shoot, that's nothing! Watch me spin him!"

Richard Tennant

GROANERS

Q: What do you call the swaying of the trees along the breezy shoulders of the information highway?

A: Al Gore rhythm.

Send your entries to *Abort, Retry, Fail?*, *PC Magazine*, One Park Ave., New York, NY 10016-5802. Winners this issue: Bernie Callis, Rolland Cooper, Chris Fillebrown, Michael J. Talarczyk, Julie Thomas, Donie Vanitizian, Dan Williams, and John M. Woram.

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